Environmental and Cultural Sustainability In the Built Environment: An Evaluation of LEED for Historic Preservation

by

Lori Ferriss

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Signature of Author...............
Department of Civil and Environmental Engineering
May 7, 2010

Certified by...
Jerome J. Connor
Professor of Civil and Environmental Engineering
Thesis Supervisor

Accepted by..
Daniele Veneziano
Chairman, Departmental Committee for Graduate Students

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ABSTRACT

Preservation of buildings is an important process for both cultural and environmental sustainability. Buildings are frequently demolished and rebuilt long before necessitated by structural or material deterioration, wasting both materials and energy. Preservation can be seen as the ultimate form of recycling; it allows existing buildings to be updated and retrofitted for continued use, optimizing the longevity of the structure while protecting its cultural significance.

Currently, there is a lack of motivation and regulation for choosing preservation over new construction. The LEED guidelines give only a small number of points for building reuse, and frequently historic restrictions interfere with measures that would produce the same types of energy savings seen in new construction. This project will use several case studies, including the preservation of Pier A in New York City's Battery Park, as examples of contemporary restoration projects that have received or are anticipating LEED ratings. I will look at these projects in the context of current LEED guildelines and proposed future revisions to investigate how the LEED system addresses issues regarding preservation, and how they could be improved to encourage more sustainable renovation practices.

Thesis Supervisor: Jerome J. Connor
Title: Professor of Civil and Environmental Engineering

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Chapter 1. Introduction

1.1 Sustainability in Historic Preservation

As sustainable design and construction gain popularity, most of the focus is on new, cutting-edge projects. Another facet of green design is sustainable building renovation, which consists of optimal reuse of existing facilities while improving infrastructure and designing for future adaptability and disassembly. Green improvements in building renovation range from more efficient energy and water use, to efforts to realize a closed-loop materials cycle, to simply restoring the passive control properties of the original design. At the same time, it is essential that these sustainability interventions are integrated as part of a responsible preservation process. While LEED recognizes major renovations as a subset of its New Construction category, there is virtually no difference in assessment of renovations and new construction. For example, LEED only recognizes overall performance of a building's energy usage and does not consider relative improvements from a former condition after renovation. This thesis seeks to identify such limitations of the LEED system and suggest alterations of the existing system to be applied specifically to the assessment of renovation projects.

1.2 Methodology

This thesis will explore the integration of historic preservation and sustainability in buildings. This will be accomplished through a literature review of existing research in this topic, including proposals that have been put forth by professionals in the field and previous case studies of LEED rated renovations, as well as a detailed case study of Pier A, a current conservation project that is pursuing LEED certification. Findings from the case study will then be evaluated in the context of the literature review to draw conclusions for improvements to the LEED system.

1.2.1 Literature Review

Until the past decade, preservation and sustainability were seen as separate and generally opposing topics. Literature about historic preservation focuses on the principles and responsibilities behind preservation as well as common practices in the field. Similarly, publications about sustainability are largely geared towards new construction and cutting edge technology in the industry. Only recent articles tackle the issue of integrating these topics. This thesis will address literature about each individual field as well as recent work that combines the two. Additionally, existing case studies will be put forth to give a sense of the scope of this issue and current work that is being completed.

As the development of this field is so recent, there a number of differing outlooks; however there has not been extensive confirmation through data or implementation. Thus, the literature review offers the views of leading professionals in the field who are bringing the case for sustainable preservation to the attention of architects, engineers, and contractors through their own experience and synthesis of existing examples in the built environment.

1.2.2 Case Study

Pier A will be used as a case study to illustrate the issue of conforming a conservation project to the LEED guidelines. As this project is currently underway, the LEED rating of the building is only a prediction, however looking at the breakdown of points is useful for dissecting the process of earning LEED certification. By discussing point for point which credits the project will earn and how each relates to preservation, this case study will provide an evaluation of the relevance and effectiveness of the LEED system to various aspects of historic preservation.

Chapter 2. Historic Preservation Background

2.1 Overview of Preservation

"An historic building is one that give us a sense of wonder and makes us want to know more about the people and culture that produced it," (Rypkema and National Trust for Historic Preservation in the United 124).

The field of architectural preservation has existed for centuries. It is a collaborative endeavor involving architects, engineers, contractors, and preservation specialists. The modern concept of conservation has its roots in the Italian Renaissance when the antiquities became valued for their architecture and history. The eighteenth-century saw the emergence of the picturesque movement, which included Romantic ruins, authentic or constructed for effect. In the nineteenth-century, renewed interest in the study of the antiquities was accompanied by an increased sense of local identity through artifacts and a common cultural history. At the same time, the highly stylistic Restoration movement was led by figures such as Viollet-le-Duc in France and Sir George Gilbert Scott in England, which sparked the Anti-Restoration movement led by William Morris. It was not until the twentieth century that policy regulating the protection of historic buildings was put into effect in the Untied States.

The main causes of decay in historic buildings are gravity loading over time, human intervention, and climactic or environmental effects. Common climatic problems are radiation, temperature, and exposure to water. Manmade destruction is frequently the result of neglect, fire, and vandalism.

The first step of conservation is to thoroughly assess and document the building in its current condition. In determining the necessary interventions, there are three questions that must first be answered:

1. What are the inherent strengths and weaknesses of the building's structure and material?
2. What are the likely sources of environmentally based deterioration?
3. What are the human causes of decay and how can they be minimized?

From these preliminary questions, a preservation design with minimal alteration to the original building can then be developed.

Conservation is defined as an intervention to actively prevent damage and control change in a building. Actions taken on historic buildings can be broken down into categories based on the degree of action necessary. The seven degrees of conservation from least to most invasive are: prevention of deterioration; preservation of the existing state; consolidation of the building's fabric; restoration; rehabilitation; reproduction; and reconstruction. Consolidation and conservation consist of the addition of supplemental material or structural support into the preexisting fabric of the building. The purpose of restoration is to "revive the original concept or legibility of the object." In all cases, conservation should be minimal and reversible to the greatest extent possible. Preservation should maximize reuse of the existing building fabric and clearly distinguish between original and new material and structure (Rypkema and National Trust for Historic Preservation in the United 124).

2.2 Economics of Preservation

When approaching a building project and deciding between new construction and renovation options, owners of existing buildings are frequently deterred by the perceived higher cost of updating an old building to standards of modern safety and comfort. It is true that for most retrofit projects, there is a new construction option that is cheaper than rehabilitation. However, this is frequently a lower quality option and produces a building with a shorter life expectancy and higher maintenance needs. Life cycle assessment evaluations demonstrate that for most cases, the restoration of historic building fabric is more economical over the life of the building than cheap replacements (Feilden 10).

The possible advantages of preservation depend on whether or not demolition is necessary prior to the construction of a new building on a given site. If no demolition is required for new construction, then restoration is economically comparable to new construction: rehabilitation costs range from an average of 12% less to 9% more than new construction of comparable quality. However, if demolition is required to erect a new building, rehabilitation of the existing structure will yield savings averaging between 3% and 16%. Rehabilitation projects can also cost less money by having a reduced construction time, up to 18% shorter than new construction.

One of the major costs associated with renovation is the replacement of old mechanical systems. Since the lifetime of these systems is generally much less than the life of the building, replacing them extends the life of the building, making the initial investment valuable in the long-term (Feilden 12). Regular maintenance and proper conservation of any building reduce the cost of major interventions over the building's life. The most effective method of preservation is regular inhabitation and maintenance. Rehabilitation is frequently the best economical way to preserve both the historic and functional value of a building (Feilden 14).

Overall, the perception that preserving an existing building is less economical than creating a new structure is not well-founded. While the initial investment for new construction may be less, rehabilitation is generally more cost effective over the entire life of the building. Historic buildings can be retrofitted to account for changes in program, and are generally of a higher quality such that when properly maintained, they will function for a long lifetime. This is another aspect of preservation that can be better quantified and valued with life cycle assessment. Since older buildings, especially those that have lasting historic significance, were generally built to function over a longer lifetime in terms of both their architectural and structural materials as well as their construction methods, it is both environmentally and economically sustainable to invest in preservation.

2.3 Environmental Impacts

Over forty percent of carbon dioxide emissions in the United States come from building construction and use (Moe 1). It follows that there are two approaches to decreasing this portion of energy consumption: decreasing construction and using existing buildings more efficiently. Historic preservation can save energy on both of these fronts; it decreases construction demand and enhances the passive control features inherent in many historic buildings.

Along with construction, demolition also consumes large quantities of energy in addition to producing waste. It takes up to between forty and sixty years for a new building to recover the energy used in demolition, even if the new building is energy efficient and forty percent of the old materials from demolition are recycled. According to the Advisory Council on Historic Preservation, a typical 50,000 square foot office building conains approximately eighty billion Btu of embodied energy; demolishing a building such as this creates about four thousand tons of waste. Historic preservation is inherently green because it conserves natural resources and energy. "When you strip away the rhetoric, preservation is simply having the good sense to hold onto things that are well designed, that link us with our past in a meaningful way, and that have plenty of good use left in them," (Moe 1).

In buildings, energy is used primarily for climate control. Inhabitants use energy for heating and cooling, ventilation, and lighting. All of these systems can frequently be made more efficient for very little cost, and can be optimized through integration with each other, especially in passive systems. For example, installing windows that allow controlled sunlight to enter a space at appropriate times of day and year can reduce the energy needed for lighting and the need for heating. Making these windows operable further reduces energy consumption by providing natural ventilation and cooling when necessary. Schemes like this are most conveniently implemented during the early stages of design and are harder to impose on an existing building, however there are usually ways to strategically incorporate the buildings features into a more efficient energy use scheme. Most historic buildings already make use of this type of passive system, and restoring the original form can therefore increase the passive control capabilities of the building.

LEED focuses on new construction, an emphasis that neglects the reality of our current built environment and the potential to reuse buildings that are already standing in more sustainable ways. "The greenest building is one that already exists," according to Moe (Moe 1). Buildings built before 1920 are on average more efficient those constructed after that point until after 2000. Before the widespread availability of artificial lighting and mechanical heating and cooling systems, buildings were by necessity more energy efficient; they relied on passive heating and cooling in addition to daylighting. In 1999, the General Services Administration found that utilities for these buildings cost about twenty-seven percent less than modern buildings. There are several physical reasons for better efficiency in older buildings. One is that more buildings designed before curtain wall construction used simple shear wall systems constructed from masonry. These buildings have greater thermal mass, which means that they will better moderate interior temperatures within a certain thermal range. Additionally, buildings designed before the widespread use of electricity are likely to have higher ceilings, large windows, shaded openings or porches, or other measures that allow the space to be controlled with less energy. Buildings were also sited to maximize winter sun exposure and minimize summer exposure (Moe 3-7).

One example of the environmental benefits of preservation is the Bauhaus homes of Tel Aviv. These buildings are being restored now as part of a UNESCO World Heritage Site. A typical preservation consists of structural stabilization, repair or renovation of materials and systems, and restoration of the original architectural forms.

The Bauhaus buildings of Tel Aviv were built primarily in the 1920s and 30s to accommodate the large influx of immigrants from Europe. They were originally designed to be functional, constructed from local materials, economical, and quick to erect. As there was minimal infrastructure at the time, they used passive cooling, such as reflective exterior surfaces and shaded balconies, and natural ventilation as much as possible (Figure 2.1). In this apartment building, note the extended balconies and large number of windows for ventilation within the units, as well as the thermometer window that provides light to the central stairwell. The walls are built from locally found sand and other materials and coated with a light color to minimize heat gains from the Mediterranean sun.

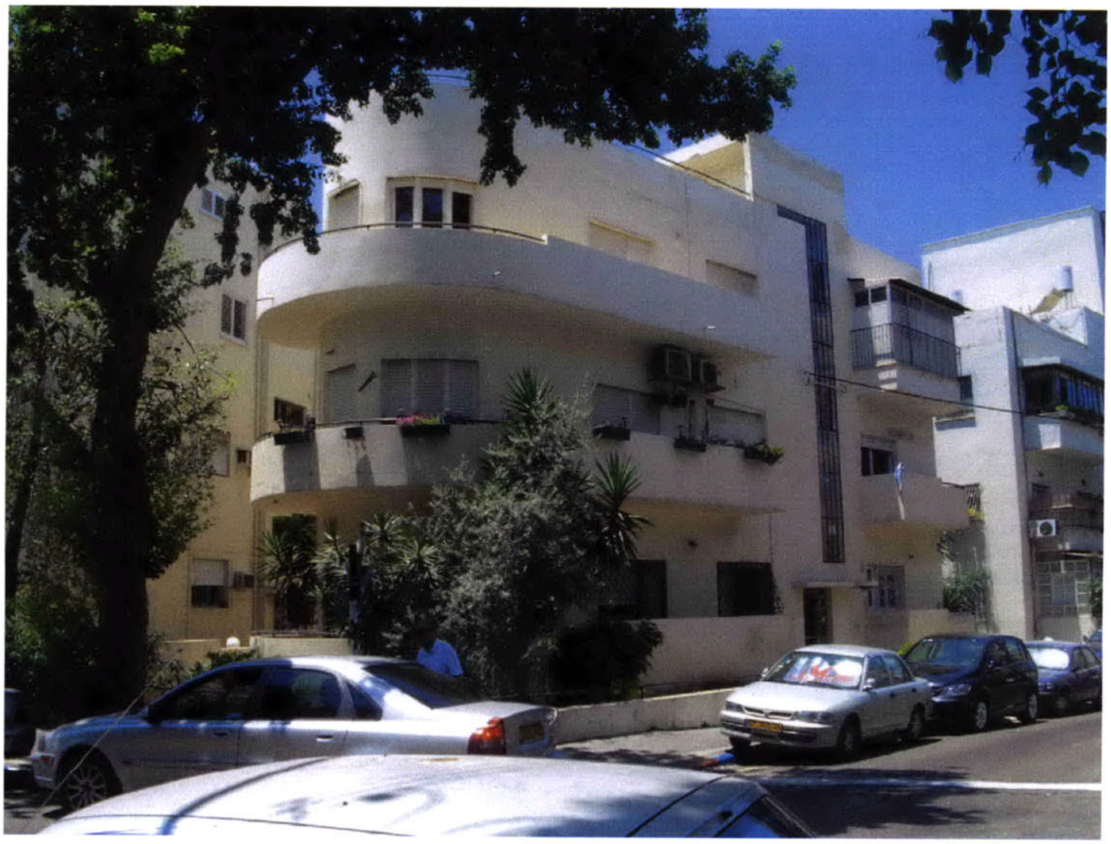

Figure 2.1 Tel Aviv Bauhaus Apartments
(Source: Lori Ferriss)

Over the decades since their construction, these buildings have been renovated to create more interior space by enclosing balconies, adding stories, and blocking off windows. These renovations diverged from the original design, compromising both the architectural integrity and passive sustainability of the houses. In addition to blocking off openings, the installation of air conditioner units required the elimination of the open plan that originally assisted natural ventilation through the spaces. The preservation of these buildings restores the original architectural intentions and provides greater passive thermal comfort.

Analysis using ENER-WIN shows that in the Max Libling Building, a typical apartment building, provided thermal comfort during ninety percent of the occupied hours in the summer in its original form. After modifications in which the balconies were enclosed with windows and shades and the stairways were closed off, the building was comfortable for only sixty-six percent of occupied summer hours. The building was preserved in 2000, and a third simulation of the restored state showed that thermal comfort was restore to ninety percent, and the overall energy used for cooling was reduced with a new central AC system. These results show that integrating active energy measures into an inherently efficient design can provide an optimally performing building (Geva 43-49).

Chapter 3. Preservation and LEED

3.1 Current LEED Guidelines

The United States Green Building Council (USGBC) is a non-profit organization committed to improving the sustainability practices of the US built environment. The USGBC was formed relatively recently in 1993. It is best known for its standardization of sustainability measures in the format of LEED (Leadership in Environmental and Energy Design). While there are other sustainability guidelines and rating systems available in the US, including Green Globes and the National Association of Home Builders Model Green Building Guidelines, LEED is by far the most popular and widely recognized across the field. Many states are now mandating that public building projects above a certain budget threshold receive a LEED Silver rating or equivalent. While other standards have tried to prove that they are equivalent to LEED, LEED is still the most popular rating system used.

LEED was spearheaded in 1994 by Robert K. Watson, the senior scientist of the Natural Resource Defense Council at the time. He put together a Steering Committee that performed a consensus process including non-profit organizations, government agencies, architects, engineers, building owners, developers, and building material manufacturers. The committee was successful in creating an environmentally conscientious rating system that was realistic in the existing building community, and that significantly decreased the environmental impact of the building process. Since its pilot version in 1994, the LEED reference guide has been updated and improved, pushing the building industry to stricter standards with each update. The current version has grown into six interrelated standards, including standards that focus on major renovations and existing buildings.

LEED was created in order to establish a common standard of measurement of sustainability, as well as to promote integrated, whole building design practices. It also stimulates competition by having a four-tiered rating system. Buildings can achieve a certified, silver, gold or platinum certification. The guidelines are divided into six major areas: *Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources,* and *Indoor Environmental Air Quality.* There is an additional category called *Innovation in Design* in which allows the project team to apply for credit for sustainability measures that were not included in the six standard sections, so long as they can prove a quantifiable environmental impact.

The LEED standard applicable to most renovation projects is LEED for New Construction and Major Renovations (Appendix A). There is also a standard called LEED for Existing Buildings that is less applicable to historic preservation. LEED for New Construction and Major Renovations (LEED-NC) lumps together new buildings and gut renovations. Many of the credits in LEED NC are applicable to both types of buildings, however there are a few that are specific to renovation.

Sustainable Sites focuses mostly on the project's site selection. It rewards intelligent site selection, population density of the area, remediation of brownfield site and access to public transportation. In a renovation project these items are predetermined and therefore do not specifically apply. The remaining credits in *Sustainable Sites* reward:

- Encouraging alternative transportation (i.e. providing bike racks and preferred parking for hybrid cars)
- Reducing the parking capacity
- Maximizing outdoor open space
- Maximizing green space on site
- Reducing the heat island effect due to dark roofing materials and dark paving

The smallest category is *Water Efficiency.* This category focuses on two main sources of water consumption: landscape irrigation and water fixtures regulated by EPACT, the Energy Policy Act passed by Congress in 1992. The Water Efficiency category is a prime example of LEED improving industry standards significantly without holding the building project to very high standards in a larger sense. It is estimated that between fifty and seventy percent of the United State's potable water is used to irrigate lawns; that makes turf grass the most irrigated crop in the country. While typical US lawns may provide some environmental benefit in providing open space, reducing heat island effect, and infiltrating storm water locally, there are many environmental costs to the groomed lawn. For example, lawns often have pesticides and other chemicals that can pollute the surrounding groundwater. LEED rewards buildings that irrigate their lawns with stormwater, or reduce the amount of potable water used to irrigate by fifty or one hundred percent. This improves the environmental costs of the American lawn dramatically. In this case, LEED allows points for anything from a 50% reduction in potable water used to no water used.

In the water fixture reduction area, LEED leaves much to be desired. The primary focus of the Water Use Reduction Category is to reduce potable water used in toilets, urinals, showers, and kitchen sinks. The category does not take into account water used for cooling towers, heating, cooling, and processing such as laundry. While reduction from water fixtures does dramatically decrease the water directly used by the building, there is much more water used to provide the power used by the building and the materials used in the building. For example, it takes approximately 32,000 tons of water to produce the amount of steel used in an average car. It takes much more to create the steel for an entire building. While the LEED Water Efficiency category does a good job of addressing the water used for landscape irrigation, it does nothing to effect reducing the water used indirectly to create the building. To improve its critera, LEED should introduce credits that reduce the water footprint. This could be done by supporting manufacturers that use stormwater or treated wastewater for production uses. It could also reward using energy providers that are conscious about their water footprint.

The *Energy and Atmosphere* portion of the LEED rating system is by far the most technical. The prerequisites ensure that the building is following ASHRAE 90.1 Energy codes set forth by the American Society of Heating, Refrigeration, and Air Conditioning Engineers. LEED then rewards any improvements, by percentage, compared to the ASHRAE 90.1 guidelines. LEED allows for credit ranging from eight to forty-four percent for existing buildings. This is similar to the irrigation credits in Water Efficiency in that it allows for a large range of efforts on the part of the design team.

Energy and Atmosphere also rewards onsite renewable energy. Encouraging onsite renewable energy is a good idea for reducing the peak amount of energy needed. However, the amount of money it costs to purchase and install solar panels, or wind turbines is often very large compared to the energy savings. Also, if the project is not situated in a very sunny or windy area, the onsite renewable energy may not produce energy steadily. In these cases, it might be more effective to donate the money that would have been spent on the renewable system to a wind farm or other renewable energy producer. LEED does reward donations of this type, but not as much as it potentially rewards on site renewable energy. Onsite renewable energy is often more effective as a visual representation of sustainable design rather than a cost-effective sustainability measure.

The *Materials and Resources* section of LEED is the only section that offers credits specifically meant for renovation projects. These credits are called 'Building Reuse' and allow one credit for maintaining seventy-five percent of existing floors, roof, and structural walls by surface area and two credits for maintaining ninety-five percent of these materials. An additional credit is available for preserving fifty percent of interior non-structural elements.

Another pair of credits is available for diverting fifty to seventy-five percent of the construction waste from landfill. This is another example of how LEED is aimed more toward new construction projects. In a new construction project, the construction waste will include a high volume of wood, concrete, steel, and other highly recyclable materials. In a renovation project, the majority of the structural items are likely to be in place. Therefore, the construction waste will be more highly constituted of flooring materials, wall partitions, and finishing materials that may be more difficult to recycle. For this reason, the LEED rating system should offer smaller credit thresholds for renovation projects.

The *Materials and Resources* section also rewards the project for using materials that are, contain recycled content, are from regional manufacturing plants, or are rapidly renewable. The credits reward points on the basis of cost percentages. For example, if twenty percent or more of the project's budget was spent on recycled materials, they can earn a point. Again, renovation projects may be at a disadvantage in this credit when compared to new construction projects. If a new construction project uses steel or concrete from a local manufacturing plant or that contains recycled content, it will greatly improve their chances of getting a materials credit because of the high cost of structural materials. The renovation project, therefore, must make a more concerted effort in obtaining recycled, regional, and rapidly renewable materials than its new construction counterpart.

The *Indoor Environmental Air Quality* credits focus more on human health and comfort rather than minimizing environmental impact. Most credits have to do with limiting products that emit gas chemicals that are considered carcinogens and airing out the building before occupancy. There are two credits in this section, IEQ 6.1 and 6.2, that address energy savings. IEQ c 6.1 and 2 are the Controllability of Systems credits. One rewards buildings for allowing occupants to individually adjust their heating and cooling. The other rewards for allowing occupants their own dimmable task lighting. This means that the building can have a set back for heating, cooling, and lighting systems that underestimates the needed usage and people are able to make adjustments that only effect their area, thereby lowering the amount of energy used.

3.2 Proposed Additions

In 2006, the first National Summit on the Greening of Historic Properties was held. The conference brought together professionals specializing in preservation and green building with the goal of reconciling criteria for LEED and the Secretary of the Interior's Standards for Rehabilitation. The two groups joined together do discuss topics including HVAC systems, materials, building envelopes, lighting, and policy. The summit decided that the USGBC must either create new LEED guidelines in addition to NC and EB or add new categories and points specially catered toward historic buildings (Del Rance).

Additionally, the Sustainable Preservation Coalition has been advising the USGBC on preservation considerations in an attempt make the LEED rating system more applicable to historic buildings. Several problems with LEED v2.2 are that it does not address values of cultural sustainability and that there is insufficient acknowledgement of the longer service and embodied energy in history building.

The Sustainable Preservation Coalition arrived at eight metrics found to be lacking in LEED v2.2 including four Life Cycle Assessment and four social and cultural categories.

1. Reduced Carbon Footprint – Construction Process

This credit would reward the preservation of embodied energy that results from preserving an existing building rather than demolishing it. Preservation involves less waste generation as well as a decrease in production and transportation of new materials.

2. Reduced Carbon Footprint – Operations and Livability

This credit would recognize energy savings resulting from passive climate control. Frequently preservation projects include the restoration of passive controls originally seen in the historic building before active systems existed or were prevalent.

3. Durability

This category recognizes the longer service life of older building materials and assemblies. Credits would be awarded based on the service life of materials versus the time required for the environment to absorb the impact.

4. Life Cycle Flexibility

This takes into consideration possible adaptability of historic building types that extends their life. This is a cradle-to-cradle approach to building sustainability.

5. Social Sustainability

This credit would acknowledge the higher use of local labor and material use found in preservation.

6. Health and Comfort

Historic buildings tend to have more individual controllability. For example, operable windows and natural lighting reduce the need for energy consuming controls.

7. Social Capital

Maintenance of historic buildings and districts discourages teardowns and urban sprawl.

8. Density

Restoring urban areas encourages pedestrian activity and an increase in mixed-use buildings.

3.3 Previous Case Studies

3.3.1 Democracy Now!

Democracy Now!, a national, independent, daily news program, recently completed the construction of a LEED Platinum targeted new studio on West 25th St. in New York City (Greenbuildingsnyc.com). The studio is 8,500 square feet in a space that was originally a printing house. The construction manager, Dennis Darcy, owner of Brooklyn Interiors, along with the systems architect, Justin Laman, took initiative with the environmental and energy efficiency of the project, making it a primary focus of the construction. The project was originally meant to acquire a LEED Silver rating under the Commercial Interiors category, however after its completion it will likely be awarded a Platinum status with between 43 to 49 LEED credits.

In addition to the standard environmentally conscientious measures, such as low-flow plumbing devices and certified lumber, the sustainable aspects of the construction focused heavily on the incorporation of recycled or reused material. For example, recycled denim was installed as insulation throughout the walls in place of typical insulation such as fiberglass. The walls were then covered in 99% recycled gypsum board as opposed to standard dry wall.

The project also took incorporated the historic aspects of the space into the sustainability of the design. Reuse was a priority for the interior finishing of the space. Old furniture was moved back into the space, and the old exterior windows were used as interior partitions (Figure 3.1, Figure 3.2). This measure both preserved a historic component of the building for future inhabitants and reduced the need for new materials and the quantity of waste. At the end of the construction process, 75% of the construction waste was diverted from landfills (Darcy).

Additionally, the existing aspects of the architecture were utilized to improve the efficiency of the space. The building had large windows as part of the historic architectural design. The renovation worked with this architectural characteristic to enhance the efficiency of the studio rather than completely redesigning the fenestration. The existing factory-style windows were refurbished to take advantage of the potential for natural lighting and maintain the historic feel of the building. The interior plan was left open to allow light to penetrate into the as much of the space as possible. This reuse of the window openins significantly reduces the amount of energy that will be needed to light the space, as well as eliminating the energy that would be required to cut new openings or fill in existing openings in the exterior masonry walls. However, large glass windows also present the problem of increased heat loss during the winter months. With the installation of appropriate windows, such as those with double or triple-paned glass, a low-emissivity coating, or a layer of inert gas, this problem can be minimized. In the case of the democracy now studio, the historic, singe-paned windows were reinstalled in the interior, reducing the need for new materials for interior partitions and maintaining a historic aesthetic (Darcy).

Figure 3.1 Open Floor Plan of *Democracy Now!* Interior

(Source: (Darcy))

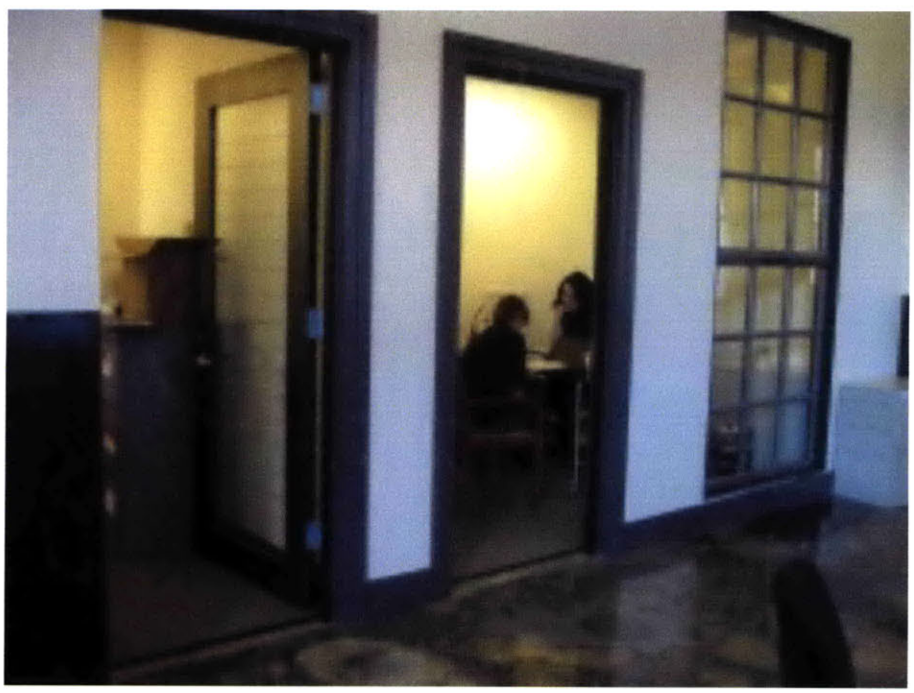

Figure 3.2 Reused Historic Window in *Democracy Now!* Studio

(Source: (Darcy))

Overall, the *Democracy Now!* renovation is an example of a project that pursued high standards of energy efficiency and environmentally responsible construction while preserving the historical nature of the building. The space was originally designed to act passively with an open floor plan and large windows for lighting and ventilation. Restoring the historic architectural intention in this case helped improve the efficiency of the space. Reusing the existing openings, the existing windows, and old furniture maintains the historic feel of the space, while state of the art materials and mechanical systems make the new space more energy efficient than it was pre-renovation.

3.3.2 President Lincoln's Cottage Visitors Education Center

The cottage, built in 1842, was used by the Lincoln family as a seasonal residence from 1862 through 1864. The visitor's education center was constructed in 1905, and achieved a LEED Gold rating for its renovation in 2000 (Figure 3.3). The project earned forty-four out of sixty-nine points with *Sustainable Sites* and *Energy and Atmosphere* as the lowest scoring categories (Campagna and Frey 21-31). This rating is particularly notable as it was granted before LEED 2009 was released, which included modifications that generally benefited historic buildings.

Figure 3.3 Lincoln's Cottage Visitor's Education Center

(Source: (Campagna))

As seen previously, restoring the original architectural form and components was a key aspect of making the building more efficient. For example, the large perimeter windows were restored down to their brass weatherstripping, improving energy efficiency as well as daylighting and views to the exterior. Additionally, the team was able to reuse ninety-eight percent of the existing walls, roof, and floors, significantly reducing the waste from the project and the quantity of new material that was needed. They also diverted seventy percent of construction debris through onsite reuse and recycling. The building also makes use of the most current sustainable materials including low volatile organic compound materials throughout the interior (Campagna).

As seen from these two examples, it is feasible for historic preservation projects to earn LEED ratings under the current system. In both cases, the buildings were by default able to overcome some of the hurdles presented to existing buildings; for example, both are situated in urban environments, so they gain a point for proximity to public transportation. In both cases, however, the commitment to pursue LEED certification while completing a sensitive preservation was an active part of the design and construction process, which requires engaging designers and contractors who are knowledgeable and willing to work with both sets of restrictions. In each building, the designers were pushed to innovate, resulting in high-quality restorations, which is a tribute to LEED. However, there are areas in which the guideline specifications not applicable to or are more difficult for historic buildings.

Chapter 4. Case Study – Pier A

4.1 Building History

Significant as the oldest functioning pier in New York City and the last remaining pier on the lower west side, Pier A is located on the Hudson River at Battery Place (gothamist.com).

Pier A was completed in 1886 as the headquarters for New York City's now defunct Department of Docks and Ferries. The Department's chief engineer, George S. Greene, Jr. designed the facility with an open holding area for equipment and materials on the ground floor and offices upstairs. The pier is 285 feet long and 45 feet wide, supporting a 322-foot building. The building, designed by C. O. Brown, consisted of a "fire-proof" east end and a wooden structure on the west end. The first floor had an essentially open floor plan, while the second floor was divided into two rows of offices (Clement).

Figure 4.1 Interior View of First Floor

(Source: (Clement))

Over the pier's history, a number of additions have been made. In 1902, the building was extended by about 50 feet on the landward side. Also at this time, a four-story tower, which would eventually be replaced by a war memorial, was constructed at the seaward end (Figure 4.2). During this period, the pier was used for the reception of visitors and as the starting point for several city parades including those honoring Charles Lindbergh and Amelia Earhart.

Figure 4.2 Historical Image of Pier A

(Source: gothamist.com)

The first major renovation took place in 1964 when the original metal façade was replaced with aluminum siding. The Battery Park City Authority gained control of the structure in 1969 with the intention of demolishing the building. In the 1970s, however, the New York Landmarks Conservancy put pressure on the group to leave the building. In 1975, it was placed on the National Register of Historic Places, and in 1988, New York City put out a request for proposals to redevelop the pier (Clement).

Pier A has been intended for a range of purposes since plans of renovation began. As of 2005, the ground floor was going to renovated for use by the Parks Service as an entry point for Statue of Liberty visitors. The 32,000 square-foot top floor is going to be leased out for either museum or restaurant purposes (Kaysen April 15, 2010). Currently, the top floor is still un-leased; according H^3 Architects, the space will likely be occupied by a museum assuming a contract can be agreed upon.

4.2 Overview of the Restoration

The current $30 million renovation of Pier A is being led by $H^{\wedge 3}$ architects and is expected to be completed by 2011 (Figure 4.3). According the architect's website, the adaptive re-use project is expected to earn at least a LEED Silver rating and aims for Gold.

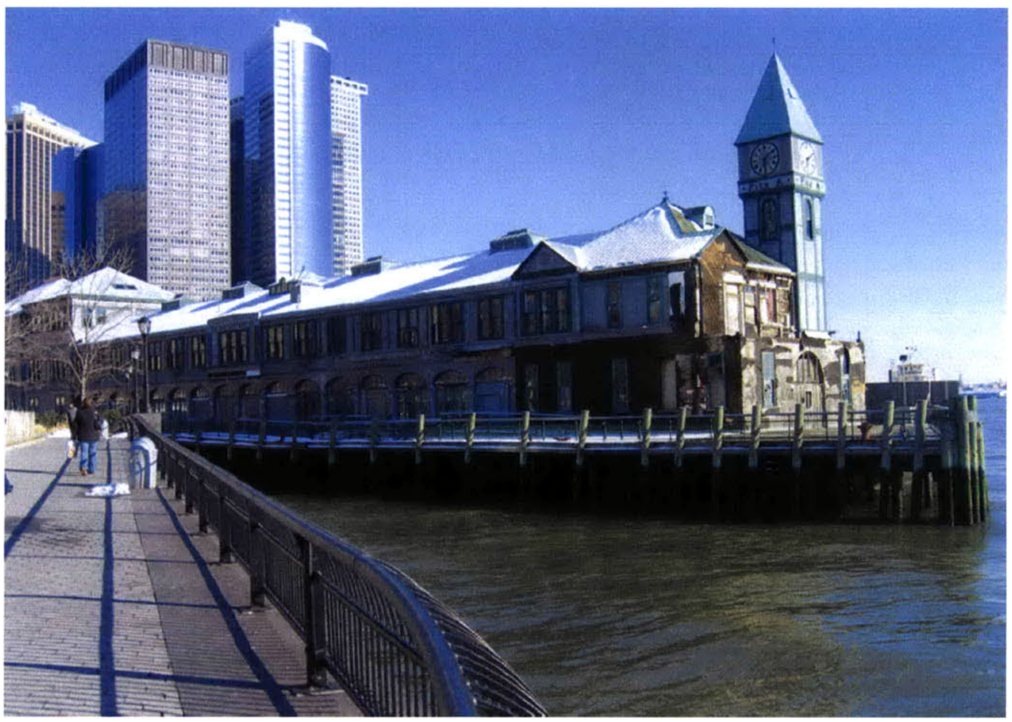

Figure 4.3 Current View of Pier A
(Source: http://www.h3hc.com)

The Pier A restoration project focuses on environmental sustainability for multiple reasons. In addition to striving for a LEED rating, the building falls under the jurisdiction of the Battery Park City Authority (BPCA), which has its own set of environmental guideline requirements. The BPCA is a New York State public benefit corporation that was founded in 1968 with the mission to "plan, create, co-ordinate and maintain a balanced community of commercial, residential, retail, and park space.”("Battery Park City Authority.") According to James Gill, the Chairman of the BPCA, when the community is completed, it will have eight green high-rise residential buildings as well as the Goldman Sachs headquarters, which will be the largest LEED certified building in the country. As Pier A is a national historic landmark, it faces unique challenges to reach contemporary sustainability standards.

4.3 LEED Scorecard

The Current LEED Scorecard for Pier A indicates the likelihood that the project will achieve each credit (Appendix B). Additionally, comments indicate strategies that need to be implemented to meet the requirements, as well as how the LEED credits fit within the BPCA guidelines.

Sustainable Sites

In the Sustainable Sites Section, Pier A will likely receive at least five points with the potential to earn another three credits. As Pier A is located in Manhattan, it complies with the *Development Density* and *Alternative Transportation* guidelines. The criteria specified in the *Tenant Design and Construction Guidelines* credit are also part of the Battery Park City Authority's sustainability criteria, so the project has a plan for informing tenants of sustainable construction and use of the building.

The majority of points that the project cannot earn are not within the renovation's scope, primarily related to parking which is not on the site of the pier. *Landscape and Exterior Design to Reduce Heat Islands* is the only credit in this category that the building will not earn because of a direct conflict between LEED and preservation principles. The roof was historically a dark red color, so installing a reflective roof or a green roof would compromise the quality of the preservation.

Water Efficiency

The project should receive three out of five possible points in this category. The Battery Park City Authority has strict requirements for low-flow plumbing fixtures and the use of reclaimed water, so these credits will be automatically met. The team is not targeting the two landscaping credits, as this is not within the scope of the project.

Energy and Atmosphere

The Battery Park City Authority has guidelines in place for almost every credit in this category, so Pier A will receive most if not all of these points. The project will have motion sensors, high performance glazing, optimized insulation, heat recovery systems, and efficient appliances. As the current heat pump system is over ten years old, testing will be completed to determine if a more recent installation is needed to meet efficiency requirements. The installation of on-site clean energy production is being explored, and methods of energy measurement will be installed.

As part of the design process, the building's energy consumption is being modeled to confirm that all standards are met. Since the space will be rented by a single occupant after completion, monitoring of actual energy use should not present a problem.

Materials and Resources

Pier A should be rewarded most of the possible points in this category. At least two if not all three points will be awarded for *Building Reuse* depending on how much of the building envelope can be restored. Additionally, the BPCA wants to reuse the existing columns, although this is not taken into account in this credit. The BPCA requires a Waste Management plan, so the Pier should earn both possible points for *Construction Waste Management.* The *Resource Reuse* credit will likely be earned for preservation of the historic walls, floors, and ceilings, although the final interior design is dependent on the final tenants preferences.

The BPCA also has more strict requirements than LEED about the use of materials with recycled content and the use of fly in concrete. Thus, Pier A will earn one if not both *Recycled Content* credits from the use of steel reinforcement, mostly in the form of rebar. A final cost estimate is yet needed to determine the final points in this area.

Indoor Environmental Air Quality

Pier A is anticipated to earn the majority of these credits, which are in many cases less strict than the corresponding BPCA guidelines. In several cases, the preservation materials are not rated as low-emitting materials, but after testing, they should meet LEED's standards. The existing window layout and thin floor plates should allow the building to earn the *Daylight and Views* credits without any additional adjustments. As seen in Figure 4.4, the building was designed before electricity, therefore enough light to perform daily tasks needed to be provided by daylight.

Figure 4.4 Natural Lighting of Workshop

(Source: (Clement))

Innovation & Design Process

In this section, Pier A will likely receive one credit for historic preservation. The intent of the project is to "preserve cultural heritage and support sustainable development" with the benefits of "less disruption to the site and neighborhood, conservation of materials, reduced extraction of new materials, and indoor quality of historic approaches to low-toxic finishes, natural daylighting and operable windows." This statement of intent summarizes numerous benefits of reusing a historic building and places the significant value of preservation in one credit.

A preliminary tally of possible LEED points shows 35 credits that Pier A will likely earn, with another 17 points listed as possible, placing it securely in the Gold range (34-44 points).

4.4 Discussion of LEED Rating

Overall, the project will probably receive an esteemed LEED Silver or Gold rating, but how does this reflect the relative environmental impact of the Pier A restoration?

There are multiple incidents when the project loses points because the credits are not within the scope of the renovation. For example, there is no parking specifically at Pier A, so no points can be earned for reducing the number of spaces or giving preference to efficient vehicles. Similarly, there is no green space on the pier, so credits cannot be earned for preserving or introducing open space. As there is no green space, the project is not eligible for the *Water Efficiency* credits for landscaping. The inability of Pier A to earn these credits makes its LEED score lower without correlating to unsustainability in the project.

In the *Materials and Resources* category, Pier A will likely earn the credits associated with building and resource reuse depending on cost evaluations. Since the entire project reuses a building that is not currently habitable, the building not earning these points would misrepresent the actual amount of reuse within the project. The *Construction Waste Management* credit is awarded for recycling or diverting certain percentages of waste from the site. A renovation project in which most of the existing building fabric is reused creates much less construction waste than new construction, especially if demolition if required; therefore, this point does not signify as much reduction in environmental impact as it would for a standard building construction. The fact that Pier

A will earn a recycled materials credit for use of reinforcing steel, which is always a primarily recycled material, also artificially increases the project's score.

In *Indoor Environmental Air Quality,* the specific products used in Pier A will be tested to ensure that they do not exceed VOC limits for low-emitting materials. This qualitative evaluation of products required in the preservation process is a meaningful assessment that will also contribute to ease of implementation of sustainability considerations in future projects.

Lastly, Pier A will probably earn a point in the *Innovation and Design Process* category for historic preservation. If this point is awarded to account for the inherently minimal environmental impact of renovation compared to demolition and new construction, or of the building's original efficient passive controls, it is a gross under acknowledgement. If, however, it is given for the cultural value of preserving a historic building, than it is not relevant to a rating of environmental sustainability of Pier A.

As seen above, the LEED rating awarded to Pier A is not consistently representative of the building's environmental sustainability. There are many cases for which historic preservation cannot be directly compared to new construction. The greatly differing processes associated with each make a side-by-side evaluation of, for example, percentage of construction waste diverted from the site, relatively meaningless. While LEED provides a helpful guideline for sustainable building and contributes standards that challenge the industry to perform more efficiently and conscientiously, a greatly modified version of LEED is needed to accurately assess and reward green preservation.

Chapter 5. Discussion and LEED Recommendations

Sustainable Sites

This category is one of the most difficult for existing buildings as most of its credits are for site selection and programmatic distribution. *Site Selection, Development Density, Brownfield Development,* and to some extent, *Site Disturbance* and *Stormwater Management,* are dependent upon the location of the building, which is pre-determined in conservation cases. Additionally, as the built environment is constantly evolving, there are cases in which a historic building would have met LEED requirements at the time of its construction but does not at the time of its restoration. For example, a building that was built before zoning mandated green space will not be able to earn the first *Reduced Site Disturbance* credit. It is difficult if not impossible to prove that a building was originally built on a Brownfield site or within a certain density environment, thus preservation projects can become ineligible for these credits..

Within LEED NC, an alternative credit for restoring a defunct building that would otherwise blight the urban landscape or require demolition could be provided in place of the *Brownfield Development* credit. Alternatively, credits based on Life Cycle Assessments that quantitatively determine the benefits of reusing a building instead of demolishing an existing building or developing open space would be important additions to LEED in this category, and could serve as the basis for a new LEED system tailored for preservation.

Water Efficiency

This category is essentially equally applicable to new construction and preservation. As plumbing fixtures and drainage systems will likely need to be replaced or updated for old buildings, it is fair to hold them to current standards of efficiency. The addition of points for 20% and 30% reduction of the water footprint of materials used in the project would encourage the industry to be more aware of water used in all facets of the construction process.

Energy and Atmosphere

In the optimizing energy performance section, renovated buildings should be required to show the percentage of improvement over the previous conditions as shown in the guidelines. However, in the case of a building that was already operationally energy efficient, performing at the percentage over the average new building specified in the guidelines, the renovation should be entitled to that number of credits regardless of percentage of improvement. In this way, efficient existing buildings will not be penalized for having a pre-existing high level of performance. The *Measurement and Verification* credit (5.1) is relevant and important for both new and existing buildings. It is important that this be included in any future versions of LEED or alternate pathway options for historic buildings.

Materials and Resources

There are many points for discussion in this section as preservation is entirely tied to the reuse of the existing building. Firstly, the *Building Reuse* points (credits 1.1-1.3) are awarded based on absolute percentage of the existing building that is reused. In the case of historic buildings, it might be impossible to reuse the existing building based on what condition the building is in and how the structural guidelines may have changed since it was last renovated. The same is true for the *Resource Reuse* credit (3.1). At the same time, historic buildings could have an easier time earning this credit as part of the conservation process is restoring existing building materials for reuse. The credits for maintaining percentages of the existing walls, floors, and roof should be adjusted to reward the maintenance of viable material. For historic structures, the rehabilitation of existing material may have a larger energy cost than simply using new material; this possibility needs to be accounted for. Similarly, the credit for maintaining interior non-structural elements could be awarded for 75%, or a more ambitious percentage, rather than fifty percent, however this should be a percentage of viable material, not total material. All of these credits could be reworked to have a more meaningful application based on the existing condition and relative importance of the exiting building's components.

The *Recycled Content* credits (4.1 and 4.2) as currently written do not necessarily indicate if a building is more or less sustainable. Pier A will receive the points for the use of structural steel, which would be included in the project regardless of sustainability concerns. Since preservation potentially uses a different distribution of construction materials than new construction, for example it may need less concrete since the structure already exists but more steel to retrofit it up to current codes, these points are not as reflective of the overall use of recycled content. While these points positively contribute to the LEED certification of the project, they are not reflective of measures taken to reduce the environmental impact of the restoration.

Local and Regional Materials (credits 5.1-5.2) could pose a special problem for historic buildings. While Pier A will likely meet the requirements, there could be cases when a building required a specific, non-local, material to maintain the historic nature of the structure. Conversely, historic buildings are likely to use more local materials if they were built before it was common to ship building materials over long distances. Preservation will also use more local labor as many tasks are highly specialized, requiring skilled labor. Also, as with *Recycled Content*, an existing building will use a different distribution of building materials, so these credits will not mean the same things in terms of the use of local and regional materials throughout the project.

Certified Wood (credit 6) could also pose a problem for historic buildings. Especially in cases where wood is visually significant, it is important to have historically appropriate wood, which may or may not be certified. In these cases, all temporary wood, such as shoring, or non-structural wood could still be held to the same criteria for certified wood.

Overall, this section requires the most adjustment for renovation compared to new construction. Additionally, we recommend several new credits in this category. The first is a credit for submitting a plan for future flexibility for reconfiguration of or addition to the space. This will make future renovation of the building inherently less energy intensive. Also, a point should be included for using at least 40% recyclable or reusable materials in the construction.

Indoor Environmental Air Quality

This category could be significantly tailored for historic buildings. The first two credits this section are awarded for *Outdoor Air Delivery Monitoring* and *Ventilation Effectiveness*. These credits are given for monitoring air flow and increasing ventilation to above the current standards. They neglect the efficiency of the system that provides ventilation. Since many historic buildings have efficient natural ventilation systems, they use less energy to provide the same airflow as a mechanical system would. Credits 1 and 2 would be more effective if they recognized this energy savings.

The *Low-Emitting Materials* credits (4.1-4.4) are more difficult for restoration projects because most preservation products are not specified yet as meeting the Volatile Organic Compound limits. After testing, they are usually shown to meet or exceed the designated limits, however these products should be standardized to encourage historic buildings to use appropriately low-impact materials.

The *Thermal Comfort* and *Daylight & Views* credits (7-8.2) have the same problem as credits 1 and 2 above. Older buildings utilized more passive thermal control and lighting than current buildings generally use. Figure 4.1 shows the large vaulted windows that were designed for the ground floor. These windows would have provided light for the Department of Docks and Ferries employees before the building had electricity. When restored, they will provide enough light to significantly reduce the amount of electric lighting needed in the building. A lighting analysis using computer simulations could be utilized to illustrate the energy savings of these lights over standard window installations. This quantitative modeling approach could be used to allot points based on providing daylight, not simply visual access to the exterior.

Acknowledging the passive control present in many historic buildings would make these credits more reflective of the building's total environmental impact. Additionally, points are awarded for allowing inhabitant control of systems through measures such as local thermostats and motion sensors for lighting. Historic buildings frequently have occupant-controlled features such as operable windows and shades; these are more sustainable ways to actively control the indoor environment and should be acknowledged for their energy savings.

Innovation and Design Process

If the main body of the guidelines is tailored to accommodate preservation, this section will no longer need to serve as a catch all for preservation. In this case, the category would instead be used for actual innovation, such as the reuse of historic windows as interior partitions in the Democracy Now! Studio.

More data and standardization of preservation architecture would greatly contribute to the accurate assessment of energy savings in historic buildings. For example, new glazing systems are thoroughly tested and documented so that they can be easily modeled and their performance can be better predicted. The same is true of new low-emitting construction or finishing products. This is more complicated for historic buildings for several reasons. One is that the existing variables in these components are much greater as they could be from any point in the building's history and their origin is frequently unknown. Additionally, before mass-production and the standardization of the building process, there was much more variation in building components and materials based on region, the architect, or numerous other factors. While it would be impossible to create a comprehensive database of properties of historic building components, it would benefit the industry to compile a library of, for example, general types of historic window assemblies, to provide a groundwork for more a accurate understanding and analysis of historic buildings.

Overall, findings from the case study closely mirror the Sustainable Preservation Coalition's Life Cycle Assessment recommendations. The inherent energy and carbon savings related to preservation are not adequately acknowledged, and these additions – *Reduced Carbon Footprint, Durability,* and *Life Cycle Adaptability* – would provide credits for buildings that fit these sustainability characteristics. Given the number of credits that would need to be adjusted to better fit preservation, it would be advisable to create a new set of guidelines, LEED for Historic Buildings, that would not be a direct comparison to new construction, but would instead be a tailored evaluation of preservation.

Chapter 6. Conclusions

Many aspects of LEED NC are important to any building project. Monitoring energy use and the indoor environment is the first step to improving the environmental sustainability of all buildngs. The decrease of water use and energy and the increased use of certified sustainable materials are important parts of greening the building field for both new and old structures. These fundamental components of LEED are key to sustainable design, and should be applied to historic preservation; however, the standards with which they are applied need to be specialized to take into account the different needs and practices of preservation.

In many cases where LEED NC credits are not applicable to existing buildings, the question should be asked: should a building be preserved if it cannot meet contemporary standards of sustainability? For example, site selection credits cannot fairly be applied to historic buildings because the owner has no control over the site's height above 100-year flood levels or proximity to wetlands or downtown developments. Additionally, a site that may have met these criteria when the building was originally constructed might not now due to changes in its environment. The historic and cultural value of a building such as this must be weighed against the need for sustainability in the built environment. It is difficult to quantify the intrinsic value of any building, but a separate set of guidelines that evaluated the overall environmental impact of historic buildings would show that in most of these cases, the inherently sustainable design of historic architecture offsets some of the other criteria that the buildings do not meet.

Preservation has the potential to substantially increase the sustainability of the built environment. The current building climate is founded on the general acceptance of the fact that buildings are disposable and will be demolished when they become outdated or programmatically unsatisfactory. This mindset is inherently unsustainable; it results in materials being discarded before their lifetime is over as well the use of energy and materials during the construction process more frequently than is necessary. The concept of restoring and adapting buildings over time to maximize their lifetime can greatly reduce the environmental impact of buildings.

The development of a separate LEED rating system for historic buildings, or the introduction of highly flexible options within LEED NC, would greatly facilitate the integration of environmental sustainability and historic preservation. Making LEED certification more attainable for renovation projects will give building owners a greater incentive to reduce their environmental impact. Alternatively, incorporating products necessary for preservation and special concerns such as authentic roofs and windows into the guidelines will also help to ensure a higher quality of conservation by encouraging appropriate attentiveness to historic accuracy. A separate LEED system for preservation would both help to guarantee that invaluable historic buildings are not sacrificed in favor of the most recent trends in sustainable design and push professionals to strive for minimal environmental impact in the future of the built environment.

Appendix A. LEED v2.2 Checklist

LEED for New Construction v 2.2
Registered Project Checklist

Project Name: ____________________

Project Address: ____________________

Yes	?	No	Project Totals (Pre-Certification Estimates)	69 Points
			Certified: 26-32 points **Silver:** 33-38 points **Gold:** 39-51 points **Platinum:** 52-69 points	

Yes	?	No	Sustainable Sites		14 Points
Yes			Prereq 1	**Construction Activity Pollution Prevention**	Required
			Credit 1	**Site Selection**	1
			Credit 2	**Development Density & Community Connectivity**	1
			Credit 3	**Brownfield Redevelopment**	1
			Credit 4.1	**Alternative Transportation,** Public Transportation	1
			Credit 4.2	**Alternative Transportation,** Bicycle Storage & Changing Rooms	1
			Credit 4.3	**Alternative Transportation,** Low-Emitting & Fuel Efficient Vehicles	1
			Credit 4.4	**Alternative Transportation,** Parking Capacity	1
			Credit 5.1	**Site Development,** Protect or Restore Habitat	1
			Credit 5.2	**Site Development,** Maximize Open Space	1
			Credit 6.1	**Stormwater Design,** Quantity Control	1
			Credit 6.2	**Stormwater Design,** Quality Control	1
			Credit 7.1	**Heat Island Effect,** Non-Roof	1
			Credit 7.2	**Heat Island Effect,** Roof	1
			Credit 8	**Light Pollution Reduction**	1

Yes	?	No	Water Efficiency		5 Points
			Credit 1.1	**Water Efficient Landscaping,** Reduce by 50%	1
			Credit 1.2	**Water Efficient Landscaping,** No Potable Use or No Irrigation	1
			Credit 2	**Innovative Wastewater Technologies**	1
			Credit 3.1	**Water Use Reduction,** 20% Reduction	1
			Credit 3.2	**Water Use Reduction,** 30% Reduction	1

LEED for New Construction v 2.2
Registered Project Checklist

Yes	?	No				
			Energy & Atmosphere			**17 Points**
Yes			Prereq 1	**Fundamental Commissioning of the Building Energy Systems**		Required
Yes			Prereq 1	**Minimum Energy Performance**		Required
Yes			Prereq 1	**Fundamental Refrigerant Management**		Required

***Note for EAc1:** All LEED for New Construction projects registered after June 26, 2007 are required to achieve at least two (2) points.

Yes	?	No				
			Credit 1	**Optimize Energy Performance**		1 to 10
				Credit 1.1	10.5% New Buildings / 3.5% Existing Building Renovations	1
				Credit 1.2	14% New Buildings / 7% Existing Building Renovations	2
				Credit 1.3	17.5% New Buildings / 10.5% Existing Building Renovations	3
				Credit 1.4	21% New Buildings / 14% Existing Building Renovations	4
				Credit 1.5	24.5% New Buildings / 17.5% Existing Building Renovations	5
				Credit 1.6	28% New Buildings / 21% Existing Building Renovations	6
				Credit 1.7	31.5% New Buildings / 24.5% Existing Building Renovations	7
				Credit 1.8	35% New Buildings / 28% Existing Building Renovations	8
				Credit 1.9	38.5% New Buildings / 31.5% Existing Building Renovations	9
				Credit 1.10	42% New Buildings / 35% Existing Building Renovations	10
			Credit 2	**On-Site Renewable Energy**		1 to 3
				Credit 2.1	2.5% Renewable Energy	1
				Credit 2.2	7.5% Renewable Energy	2
				Credit 2.3	12.5% Renewable Energy	3
			Credit 3	**Enhanced Commissioning**		1
			Credit 4	**Enhanced Refrigerant Management**		1
			Credit 5	**Measurement & Verification**		1
			Credit 6	**Green Power**		1

LEED for New Construction v 2.2
Registered Project Checklist

Yes	?	No	Materials & Resources		13 Points
Yes			Prereq 1	**Storage & Collection of Recyclables**	Required
			Credit 1.1	**Building Reuse,** Maintain 75% of Existing Walls, Floors & Roof	1
			Credit 1.2	**Building Reuse,** Maintain 95% of Existing Walls, Floors & Roof	1
			Credit 1.3	**Building Reuse,** Maintain 50% of Interior Non-Structural Elements	1
			Credit 2.1	**Construction Waste Management,** Divert 50% from Disposal	1
			Credit 2.2	**Construction Waste Management,** Divert 75% from Disposal	1
			Credit 3.1	**Materials Reuse,** 5%	1
			Credit 3.2	**Materials Reuse,** 10%	1
			Credit 4.1	**Recycled Content,** 10% (post-consumer + 1/2 pre-consumer)	1
			Credit 4.2	**Recycled Content,** 20% (post-consumer + 1/2 pre-consumer)	1
			Credit 5.1	**Regional Materials,** 10% Extracted, Processed & Manufactured	1
			Credit 5.2	**Regional Materials,** 20% Extracted, Processed & Manufactured	1
			Credit 6	**Rapidly Renewable Materials**	1
			Credit 7	**Certified Wood**	1

Yes	?	No	Indoor Environmental Quality		15 Points
Yes			Prereq 1	**Minimum IAQ Performance**	Required
Yes			Prereq 2	**Environmental Tobacco Smoke (ETS) Control**	Required
			Credit 1	**Outdoor Air Delivery Monitoring**	1
			Credit 2	**Increased Ventilation**	1
			Credit 3.1	**Construction IAQ Management Plan,** During Construction	1
			Credit 3.2	**Construction IAQ Management Plan,** Before Occupancy	1
			Credit 4.1	**Low-Emitting Materials,** Adhesives & Sealants	1
			Credit 4.2	**Low-Emitting Materials,** Paints & Coatings	1
			Credit 4.3	**Low-Emitting Materials,** Carpet Systems	1
			Credit 4.4	**Low-Emitting Materials,** Composite Wood & Agrifiber Products	1
			Credit 5	**Indoor Chemical & Pollutant Source Control**	1
			Credit 6.1	**Controllability of Systems,** Lighting	1
			Credit 6.2	**Controllability of Systems,** Thermal Comfort	1
			Credit 7.1	**Thermal Comfort,** Design	1
			Credit 7.2	**Thermal Comfort,** Verification	1
			Credit 8.1	**Daylight & Views,** Daylight 75% of Spaces	1
			Credit 8.2	**Daylight & Views,** Views for 90% of Spaces	1

LEED for New Construction v 2.2
Registered Project Checklist

Yes	?	No	Innovation & Design Process		5 Points
			Credit 1.1	**Innovation in Design:**	1
			Credit 1.2	**Innovation in Design:**	1
			Credit 1.3	**Innovation in Design:**	1
			Credit 1.4	**Innovation in Design:**	1
			Credit 2	**LEED® Accredited Professional**	1

Appendix B. Pier A LEED Scorecard

KEY:
Likely: The project has met or can easily meet the necessary requirements.
Possible: The project could meet these requirements w/ minor design changes or low incremental costs.
Less Likely: Possible, but requiring design changes and/or additional costs.
Not Viable: Not applicable to this building type, cost prohibitive, or not targeted.
TBD: To be determined.

Likely	Possible	Less Likely	Not Viable		LEED CS v2.0 Credits		BPCA Residential Environmental Guidelines Requirements - May 2005	Strategies/Actions
6	5	1	3	Sustainable Sites		BPCA Section		
Required				Prereq 1	**Construction Activity Pollution Prevention. Create and implement an Erosion and Sedimentation Control Plan for all construction activities associated with the project. The plan shall conform to the EPA standards referenced in the LEED-CS v2.0 Reference Guide or local codes; whichever is more stringent.**	5.1	.4 Design a site-specific Sediment and Erosion Control Plan that conforms to the United States Environmental Protection Agency (EPA) Document No. EPA 832/R-92-005 (September 1992), Storm Water Management for Construction Activities, Chapter 3, or local erosion and sedimentation control standards and codes (whichever is more stringent). The plan shall meet the following objectives: .a Prevent loss of soil during construction by storm water runoff and/or wind erosion, including	**Strategies:** **Contractor will be required to create and implement plan. No civil drawings will be created.** **Actions:** **Add ESC Specification requirement to each bid package. BPCA 3.9.1 and 3.9.2 (VEE)**

		protecting topsoil by stockpiling for reuse. .b Prevent sedimentation of storm sewer or receiving streams and/or air pollution with dust and particulate matter. .c Prevent construction contaminants from entering the storm sewers, including but not limited to high pH concrete slurry and chemicals associated with machinery operations 3.9 .1 Use ultra-low sulfur diesel fuel or compressed natural gas (CNG) for all construction vehicles with a carrying capacity in excess of 5 tons and for all portable generators, consistent with Local Law 77 for Lower Manhattan. .2 Equip the above vehicles with high performance engines and diesel oxidation catalyst (DCC) filters or another previously demonstrated advanced retrofit technology, consistent with NYC Local Law 77 for Lower Manhattan.	
1	Credit 1 **Site Selection** **Avoid farmland, land with elevation lower than 5 ft. above 100-yr. flood, endangered species habitat, land within 100 ft. of water including wetlands, public parkland.**		**Strategies:** **-Predeveloped need not comply with water body or flood level requirements** **Actions:** **-Confirm all criteria met (H3)** **-BPCA SEQR sent to VEE 1/28/09, will review**

				for information (VEE)
1	Credit 2	**Development Density** Project to be in established, walkable community with min. density 60,000 SF per acre net (2-story downtown development), OR project within 1/2 mile of residential zone or neighborhood with average density 10 units per acre net AND within 1/2 mile pedestrian access to at least 10 of the following basic services: bank, place of worship, convenience grocery, day care, cleaners, fire station, hair care, hardware, laundry, library, medical/dental, senior care facility, park, pharmacy, post office, restaurant, school, supermarket, commercial office, community center.		Strategies: The project should comply with connectivity option. Actions: Confirm services and proximity of residential neighborhood (VEE)
1	Credit 3	**Brownfield Redevelopment** Develop on site documented as contaminated (by ASTM E1903-97 Phase II Environmental Site Assessment), OR classified as "Brownfield" by local, state, or federal government agency. Remediate site contamination.		Strategies: Asbestos remediation per EPA 40 CFR, part 763 can earn. They are testing for asbestos but don't expect to find any due to previous work done on building. Actions: Provide test results (Catylyst Group)

1	Credit 4.1	**Alternative Transportation, Public Transportation Access** **Locate project within 1/2 mile of existing or planned and funded commuter rail, light rail, or subway station, or 1/4 mile of 2 or more public or campus bus lines.**	.	**<u>Strategies:</u>** **<u>The project should comply.</u>** **<u>Actions:</u>** **<u>Document credit (VEE)</u>**
1	Credit 4.2	**Alternative Transportation, Bicycle Storage & Changing Rooms:** **- For commercial or institutional buildings. < 300,000 GSF: provide bicycle storage for 3% regular building occupants and provide convenient changing/shower facilities (w/in 200 yards. of bldg.) for 0.5% Full-Time Equivalent (FTE) occupants.** **- For projects >300,000 GSF: provide bicycle storage for 3% of occupants up to 300,000 SF, then for 0.5% above 300,000 SF. Provide shower and changing facilities for 0.5% FTE.**	1.3 .1 Provide enclosed bicycle storage for a minimum of 5% of building occupants. .2 Provide showers, lockers and changing facilities for bicycle commuters (health club facilities within the building may satisfy this requirement if these bicyclists are not required to pay a fee for use of the facility). (from Commercial BPCA guidelines)	**<u>Strategies:</u>** **<u>Default occupancy is gross 550 SF/person per full time employee (retail space). Transient occupancy assumed 2,000 people (from H3 program development study). 104 bike racks and 1 shower required. If tenant is secured, occupancy can be adjusted.</u>** **<u>Actions:</u>** **<u>Provide bike racks and showers per BPCA Guidelines (H3)</u>**
1	Credit 4.3	**Alternative Transportation, Low Emitting & Fuel Efficient Vehicles** **- Provide preferred parking for low-emitting and fuel efficient vehicles for 5% of the total vehicle parking capacity of the site** **OR** **-Install alternative fuel refueling stations for 3% of the total vehicle parking capacity on the site.**		**<u>Strategies:</u>** **<u>Would require contract with parking facility within 1/4 mile of site.</u>** **<u>Actions:</u>** **<u>None</u>**

1	Credit 4.4	**Alternative Transportation, Parking Capacity** - Size parking capacity to meet, but not exceed local zoning requirements OR - For projects providing parking capacity for less than 3% FTE, provide preferred parking for carpools/vanpools for a total of 3% of the total parking provided OR - Size parking capacity to meet, but not exceed local zoning requirements AND provide infrastructure to support carpools/vanpools, shuttle services, car share programs, mass transit, rider boards, etc. OR - Provide no new parking		**Strategies:** Project has no parking. **Actions:** Document credit (H3)
1	Credit 5.1	**Reduced Site Disturbance, Protect or Restore Open Space** - For greenfield sites: limit site disturbance to 40 ft. beyond bldg. perimeter, 10 ft. beyond walkways/patios/parking, 15 ft. beyond primary roadway curbs/walkways/main utility trenches, 25 ft. beyond constructed areas w/ permeable surfaces - For previously developed sites: restore min. 50% of site area (excluding bldg. footprint) by replacing impervious surfaces w/ native or adapted vegetation.		**Strategies:** Landscaping has been removed from scope **Actions:** None
1	Credit 5.2	**Reduced Site Disturbance, Development Footprint** Project to exceed local zoning's open space requirement by 25%, OR if no local zoning ordinance, designate open space adjacent to building equal to bldg. footprint, OR where there is zoning but no open space		**Strategies:** Landscaping has been removed from scope **Actions:** None

		requirement and project located in urban area, designate open space equal to 20% of project site area (green roofs can count toward compliance).		
1	Credit 6.1	**Stormwater Management, Quantity Control** **- If existing imperviousness < 50%, implement a stormwater management plan that prevents post-development peak discharge rate and quantity from exceeding the pre-development peak discharge rate and quantity for the one and two-year, 24 hour design storms OR** **- Implement a stormwater management plan that protects receiving stream channels from excessive erosion by implementing a stream channel protection strategy and quantity control strategies OR** **- If existing imperviousness > 50%, implement a stormwater management plan that results in a 25% decrease in volume of stormwater runoff from the two-year, 24-hour design storm.**	5.1 .1 Provide for 2.4 in. of rainwater falling on all building roofs and setbacks to be collected, treated, and stored on-site for reuse. Uses for this water must include cooling tower, irrigation, and building and sidewalk maintenance and laundry, if allowed by municipal codes. Due to its lower treatment requirements, storm water is to be used before reclaimed water. Other uses may be proposed by developer. Non-summer uses must be accounted for as well. .2 Adopt Best Management Practices (AMP, as	**<u>Strategies:</u>** **<u>Reuse at flush fixtures will be small with low flow fixtures. Tank will be evaluated by project demand, not credit threshold.</u>** **<u>There is approx 14,000 SF of roof that will collect approx 20,000 gallons/year based on 2.4 inches of rain. Tank will take 23 days to drain based on toilet flushing only. Other uses include site washing (AKF 1/29/09)</u>** **<u>Actions:</u>** **<u>Provide maintenance schedule to estimate site washing usage (BPCA)</u>** **<u>Determine total demand and prepare design option for evaluation (VEE, AKF)</u>**

			_p_u_b_l_i_s_h_e_d_ _b_y_ _t_h_e_ _O_f_f_i_c_e_ _o_f_ _W_a_s_t_e_w_a_t_e_r_ ,_ _E_n_v_i_r_o_n_m_e_n_t_a	
1	Credi t 6.2	**Stormwater Management, Quality Control -Implement a stormwater management plan that reduces impervious cover, promotes infiltration, and captures and treats the stormwater runoff from 90% of the average annual rainfall using acceptable best Management Practices (BMPs). The BMP must be capable of removing 80% of the average annual post development total suspended solids (TSS) load based on the existing monitoring reports.**		**<u>Strategies:</u>** **<u>AKF is designing a sand filter with trace chlorine. Must confirm that 90% annual rain fall is treated.</u>** **<u>Actions:</u>** **<u>Determine if 90% annual incident rainfall is filtered by design (AKF)</u>**

1	Credit 7.1	**Landscape & Exterior Design to Reduce Heat Islands, Non-Roof** **Provide any combination of the following strategies for 50% of the site hardscape:** **- Shade within 5 years of occupancy** **- Paving materials with a Solar Reflective Index (SRI) of at least 29** **- Open grid paving system** **OR** **- Place a minimum of 50% of all site parking under cover. Any roof used to shade or cover parking must have an SRI of at least 29.**		**Strategies:** **Can include small portion of existing paving to earn. There is no existing paving in the scope** **Actions:** **None**
1	Credit 7.2	**Landscape & Exterior Design to Reduce Heat Islands, Roof** **- Use roofing materials having required Solar Reflectance Index of 29 for steep sloped roofs or 78 for low sloped roofs for a minimum of 75% of roof surface, OR** **- Install green/vegetated roof for a minimum of 50% roof area, OR** **- A combination of the options calculated in accordance to the formula provided in the LEED-CS v2.0 Reference Guide.**		**Strategies:** **Historic color is most likely a dark red. If not, it will likely be painted green (iron oxide). Neither is expected to meet LEED requirements.** **Actions:** **Test colors for SRI (H3, VEE)**

1	Credit 8	**Light Pollution Reduction Minimize light trespass from the building and site, reduce sky-glow to increase night sky access improve nighttime visibility through glare reduction, and reduce development impacts on nocturnal environments. Refer to the LEED-CS v2.0 Reference Guide for further details.** **LZ3 - Medium (Commercial/Industrial, High-Density Residential) Design exterior lighting so that all site and building mounted luminaires produce a maximimum initial illuminance value no greater than 0.20 horizontal and veritcle foot candles at the site boundary and no greater than 0.01 horizontal footcandles 15 feet beyond the site. Document that no more than 5% of the total initial designed fixture lumens are emitted at an angle of 90 degrees or higher from nadir (straight down). For site boundaries that abut public rights of way, light trespass requirements may be met relative to the curb line instead of the site boundary.**	5.6	.1 Design interior lighting so that the angle of maximum candela from each interior luminaire as located in the building shall intersect opaque building interior surfaces and not exit out through the windows. .2 Design exterior lighting so that all site and building mounted luminaires produce a maximum initial illuminance value of no greater than 0.60 horizontal and vertical footcandles at the site boundary and must drop off to 0.01 footcandles within 15 feet beyond the site. Document that no more than 10% of the total initial designed fixture lumens are emitted at an angle of 90 degrees or higher from the nadir (straight down). For site boundaries that abut public rights-of-way, light trespass requirements may be met relative to the curb line instead of the site boundary. Use daylight sensors in combination with astronomical time clocks to minimize exterior light usage.	**Strategies: H3 to design lighting. Power density and light spill are not expected to be a problem. If LEED site is extended for light trespass, could be a problem for SSc6 Stormwater Management. Actions: Design to credit requirements and produce photometric documentation (H3)**

Likely	Possible	Less Likely	Not Viable	Credit	Description	Requirement	Strategies / Actions
1				Credit 9	**Tenant Design & Construction Guidelines** **Publish an illustrated document that provides tenants with design and construction information that:** **• Provides a description of the sustainable design and construction features incorporated in the core and shell project and lists the LEED Core and Shell credits achieved with a description of how each credit was achieved and the importance of each;** **• Coordinates with the core and shell's building systems and materials; and** **• Incorporates user friendly recommendations including examples, strategies, products and service suggestion;** **• Coordinates with LEED Commercial Interiors** **• Provides info. on elimination or control of environmental tobacco smoke.** **• Provides info. on core and shell commissioning.**	4.1 .3 The developer shall develop and maintain a comprehensive Tenant Guide and make it available to tenants in print form at lease signing and on-line for continuous updating.	**Strategies:** **BPCA requires guidelines for all projects. EEMs required for energy reduction may be made mandatory for tenants (i.e. CO2 monitoring or daylight dimming) BPCA has already started some tenant guidelines.** **Actions:** **VEE to give BPCA a list of reqs to go into tenant requirements. Produce tenant guidelines and binding lease requirements (BPCA)**
Likely	Possible	Less Likely	Not Viable				
3	0	0	0	**Water Efficiency**			
			1	Credit 1.1	**Water Efficient Landscaping, Reduce by 50%** **Reduce potable water consumption for irrigation**		**Strategies:** **Landscaping not in scope**

		by 50% over conventional means		
1	Credit 1.2	**Water Efficient Landscaping, No Potable Use or No Irrigation** **Use only captured rain, recycled site wastewater, or treated water to eliminate ALL potable water use for site irrigation, OR do not install permanent irrigation system.**	5.2 .3 Utilize non-potable drip irrigation systems (if applicable).	**<u>Strategies:</u>** **<u>Landscaping not in scope</u>**
1	Credit 2	**Innovative Wastewater Technologies** **Reduce municipally provided potable water for building sewage conveyance by a minimum of 50% through water conserving fixtures or non-potable water OR - Treat 50% of wastewater on site to tertiary standards. Treated water must be infiltrated or used on-site.**	5.2 .3 Use reclaimed water for toilet flushing, cooling tower make-up, irrigation, laundry (to the extent allowed), building and sidewalk maintenance management uses (in all cases, if applicable and properly treated). Provide clearly labeled "Reclaimed Water" taps wherever treated water is made available to tenants and/or staff. Address the issue of excessive chloride build-up in cooling tower system.	**<u>Strategies:</u>** **<u>Storm water reuse will be required. (1/29/09) Project team has decided to target this credit. 2.4" of all roof is approx 20,000 gallons based on a 14,000 SF roof. Collection system will be sized to eliminate 100% potable waste water use.</u>** **<u>Actions:</u>** **<u>Determine required per LEED calculation methodology (VEE) Size system accordingly (AKF)</u>**
1	Credit 3.1	**Water Use Reduction, 20% Reduction** **Use 20% less water than water use baseline in accordance with EPACT 1992.**	5.2 .1 Install fixtures that in aggregate use 10% less potable water than the water usage requirements in the Energy Policy Act of 1992, including dishwashers and clothes washers. When performing the calculation, do not include fixtures which are using reclaimed water. .2 Specify low water volume/conserving fixtures and	**<u>Strategies:</u>** **<u>Only bathroom fixtures in core and shell scope. Low flow fixtures will be specified. Other BPCA requirements must be met through tenant lease requirements.</u>** **<u>Actions:</u>** **<u>Specify 0.125 gpf urinals, low or dual flush toilets, 0.5 gpm lavatory faucets with sensors (H3, VEE) Add other fixture</u>**

Likely	Possible	Less Likely	Not Viable				
						dishwashers, dual flush or 1.6 gallon toilets, and only front-loading laundry facilities with a water factor of 7.5 or less.	**requirements to tenant guidelines (BPCA)**
1				Credit 3.2	**Water Use Reduction, 30% Reduction** **Use 30% less water than water use baseline in accordance with EPACT 1992.**		
8	4	0	2	**Energy & Atmosphere**			
Required				Prereq 1	**Fundamental Building Systems Commissioning (Cx)** **- Verify the building's energy related systems are installed, calibrated and perform according to the Owner's Project Requirements, Basis of Design, and construction documents.**	See LEED EAc3 (BPCA req 4.2.1)	**Strategies:** **BPCA to contract CxA. OPR and BOD review should commence ASAP.** **Actions:** **Provide documents when available (BPCA)**

Re qu ire d		Prere q 2	**Minimum Energy Performance** **-Design the building in compliance with ASHRAE/IESNA Standard 90.1-2004 AND** **- Meet the prescriptive requirements or performance requirements of ASHRAE/IESNA Standard 90.1-2004**		**<u>Strategies:</u>** **<u>Energy model will prove minimum energy performance requirements.</u>** **<u>AKF and H3 to design to mandatory provisions.</u>** **<u>Actions:</u>** **<u>Preliminary energy model run (VEE)</u>** **<u>Development compliant design, mandatory provisions (H3, VEE)</u>**
Re qu ire d		Prere q 3	**CFC Reduction in HVAC&R Equipment** **- Zero use of CFC-based refrigerants in new base building HVAC&R systems**	3. 6	.1 Prohibit use of CFC-based equipment. .2 Avoid the use of insulation materials that utilize chlorine based gases in the production process.	**<u>Strategies:</u>** **<u>HVAC will comply, including potentially reused AC.</u>** **<u>BPCA insulation requirements must be added to spec.</u>** **<u>Actions:</u>** **<u>Provide spec language for insulation (VEE)</u>**
4 2 2		Credi t 1.1	**Optimize Energy Performance, Reduce proposed bldg. performance rating compared to baseline bldg. performance rating per ASHRAE/IESNA 90.1-2004 (w/o Amendments) for total energy consumption within and associated with the bldg. project, as demonstrated by whole bldg. project simulation using Bldg. Performance Rating Method in Appendix G of the Standard., by the following:** **New Bldgs Extg Bldgs Points** **10.5% 3.5** **1** **14% 7%** **2** **17.5% 10.5%** **3** **21% 14%** **4** **24.5 17.5%**	1. 1	3. Provide motion sensors in stairwells, corridors, mechanical rooms (where operationally feasible), garages, and storage rooms to reduce lighting loads. 5. The minimum standard for all windows and exterior glazing assemblies will be double-glazed units with Low-E glass (U-factor of 0.33 or less and solar heat-gain coefficient of 0.37 or less) with thermally broken frames and insulated spacers. 6. Install a double later of insulation, backer rods, and caulking at top of masonry walls and wall/slab joints. 7. Optimize insulation of	**<u>Strategies:</u>** **<u>BPCA will require 30% over ASHRAE 90.1-1999 with a goal of 35%.</u>** **<u>Must determine tenant requirement to contribute to energy savings, e.g.:</u>** **<u>-CO2</u>** **<u>-Daylighting</u>** **<u>-Energy Star appliances</u>** **<u>(1/29/09) Project plans to use existing heat pumps. Equipment is 10 years old. For energy savings, we will have to see what's feasible. VEE to work with AKF. Likely tenant is DIA center. Model should look at effects of a museum space. BPCA req 1.1.8 may be an ID credit.</u>** **<u>Design must meet prescriptive requirements of BPCA</u>**

[redacted]	28% 31.5% 35%	5 21% 6 24.5% 7 28% 8	cavity wall construction. Consider installing rigid or semi-rigid insulation against the winter/ cold CMU surface and limiting infiltration through walls by providing an exterior air/water barrier applied to the winter/cold surface of the CMU.	<u>**1.1.**</u> <u>**Actions:**</u> <u>**Preliminary energy run based on proposed design (VEE)**</u> <u>**Meet prescriptive requirements of BPCA (AKF)**</u> <u>**Set minimum energy efficiency target (BPCA)**</u> <u>**Add tenant lease agreement requirements (BPCA)**</u>
			6. Install a double layer of insulation, backer rods, and caulking at top of masonry walls and wall/slab joints. 8. Conduct continuity tests for air, thermal and water barriers. Perform pressure-assisted smoke tests to detect and remedy pathways for air leakage in exterior walls. Alternatively, perform blower door tests 9. Use only 'Energy Star' or equivalent equipment, appliances, lighting and fixtures. 11. Provide thermal energy recovery systems to utilize residual heat from all building systems (i.e. from the cooling tower, exhaust air vents, boiler or chiller systems, etc.) 12. Design the building's electrical distribution system to allow for maximum utilization of electric demand reduction	

[redacted]			and demand response technologies and strategies. 13. Use alternatives to the electric resistance humidification system to increase energy efficiency.	
		EE Add 1.1	Increase energy efficiency by 35% over 2002 ECCCNYS, measured in terms of energy cost.	
		EE Add 1.2	Use enthalpy heat wheel technology for year-round conditioning of air for 75% of apartments. (Measure results in significant energy savings and will greatly aid in achieving EE Alt 1.)	
		EE Add 1.3	Provide a minimum of 30 tons cooling and heating using geothermal technology.	
		1.2	1. The developer shall prepare the initial energy model based on BPCA's list of base case assumptions to establish a standard for the project. The developer's engineering consultant will utilize this model as the design progresses to assess the energy efficiency of the building	

			and evaluate systems and design alternatives at appropriate milestones.	
1	Credi t 2	**Renewable Energy, 1% Supply at least 1% of the building's core and shell energy use (as expressed as a fraction of annual energy cost) through the use of on-site renewable energy systems.**	1. 1. Provide clean 3. combined heat and power technologies: microturbines, fuel cell and/or bio fuel cogeneration equipment. Provide a cogeneration system that demonstrates a total energy efficiency (electric generation + recovered heat)/ (total fuel input) of at least 75% with an electrical conversion ratio of at least 25% (net) and with emissions compliant with 4OCFR 60, Regulation 10, Subpart GG, and Bay Area Air Quality Management District Regulation 9-9-301. .2 Provide on-site renewable energy generation systems such as building integrated photovoltaics (BIPVs), and/or wind power that contribute a minimum of 0.75% of the energy (kWh) of the base building. This production usually requires the equivalent of a photovoltaic array with a rated capacity of approximately 5% of the base building's regulated equivalent peak demand. .3 Specify adaptable equipment that can	**Strategies:** **PV under consideration. Custom panels can provide options for historical roof. Preservation Architect willing to look at BIPV between roof seams. A crystalline silicon panel would have 714,000 kwH output (AKF 1/29/09) but less efficient. Another potential option is tidal wave generation. Although likely cost prohibitive and still an unproven technology. VEE to research. BPCA to pursue potential incentives if tidal power proposed.** **Actions: Determine viable renewable options for project (AKF, H3, VEE, BPCA)**

			accept multiple fuel sources when available (i.e. bio fuels versus natural gas).	
1	Credit 3	**Additional Commissioning (Cx)** **Implement or have a contract in place to implement the following additional commissioning tasks:** **1. A commissioning authority independent of the design team shall review the design prior to the construction documents phase.** **2. An independent commissioning authority shall review the construction documents near their completion and prior to issuing.** **3. An independent commissioning authority shall review the contractor submittals relative to systems being commissioned.** **4. Provide the owner with a single manual that contains the info required for re-commissioning building systems.** **5. Have a contract in place to review building operation with O&M staff**	4.2 .1 Engage a commissioning team that does not include individuals directly responsible for project design or construction management. This team shall include a commissioning authority independent of the design team (the Independent Commissioning Authority, or CA). .2 Develop and utilize a Commissioning Plan for all operating equipment, including HVAC equipment and systems including base building heating, cooling, and ventilation systems, apartment HVAC systems, heat recovery, building management system (BMS), plumbing systems including waste water reclamation system	**Strategies:** **BPCA will pursue CxA contract.** **Actions:** **BPCA to hire a NYSERDA approved Cx Agent**

[redacted]	**and resolve outstanding commissioning issues, within one year of construction completion.** **6. Verify that the requirements for training operating personnel and building occupants are completed.**	and storm water systems, electrical systems including lighting controls and occupancy sensors, photovoltaics, supply and exhaust air, and any other green system or equipment. .3 Incorporate commissioning requirements into the construction documents. .4 The ICA shall:	
		a. Conduct a review of the design prior to the Construction Documents phase, including review of the design intent and the basis of design documentation, b. Conduct a review of the construction documents near completion of the construction document development and prior to issuing the contract documents for bidding. c. Review the contractor submittals relative to systems being commissioned and verify installation, functional performance, training, operation, and maintenance documentation. d. Complete and provide the developer with a Commissioning Report, including a single manual that contains the information required for re commissioning building	

			systems. e. Review building operation with O&M staff, including a plan for resolution of outstanding commissioning related issues within one year after construction completion or 90% rent-up date.	
1	Credit 4	**Ozone Protection** **- Do not use refrigerants** **OR** **- Select refrigerants and HVAC&R that minimizes or eliminates the emissions of compounds contributing to global warming and ozone depletion.**	**that originally used R-22 refrigerant. Trane is looking into alternative refrigerants.**	**Strategies:** **-AC reuse could jeopardize** **-Trane is looking into using a different refrigerant other than R-22, the original equipment specification.** **Actions:** **Determine energy requirements of system and feasibility of AC reuse (AKF)** **Determine alternate refrigerants for existing equipment and specify compliant refrigerant for new (AKF)** **Run LEED calculations (AKF or VEE)**
1	Credit 5.1	**Measurement & Verification, Base Building** **• Provide the necessary infrastructure within the base building design to facilitate metering building electricity and tenant electrical end-uses as appropriate.** **• Develop a building M&V Plan consistent with**	1.2 3. The developer shall install dedicated meters to provide data sufficient to evaluate individual EEMs and specialized building systems (e.e HVAC, lighting, central plant, and green cogeneration equipment), as well as overall building performance. For specific	**Strategies:** **BPCA indicates project must comply with BPCA M&V guidelines.** **VEE recommends pursuing both M&V LEED credits.** **Energy model can be used to pursue Option D.**

		Option D: Calibrated Simulations OR Option B: Energy Conservation Measure Isolation, as specified in the IPMVP Volume III: Concepts and Options for determining Energy Savings in New Construction, April 2003.		monitoring requirements, see BPCA Residential Environmental Guidelines May 2005 1.2.3	**<u>Actions:</u>** **<u>Provide proposal for IPMVP Plan development (AKF)</u>**
1	Credit 5.2	**Measurement & Verification, Tenant Sub-metering** **- Provide centrally monitored metering network in base building design with capability to be expanded to accommodate future tenant sub-metering (i.e., to earn this credit, need only provide infrastructure for future tenant sub-metering).** **- Develop tenant M&V plan to guide future tenants.**			**<u>Strategies:</u>** **<u>With one tenant, this will be simple. If DIA does not occupy, guidelines must dictate metering. All unbuilt metering must be required in tenant guidelines.</u>** **<u>Actions;</u>** **<u>Provide proposal for IPMVP Plan development (AKF)</u>**
1	Credit 6	**Green Power** **Provide at least 35% of the building's core & shell electricity from renewable sources by engaging in a minimum 2-yr. renewable energy contract.**	1.3	.4 Use best efforts to enter into a 5-year contract to purchase 25% of the base building's power from energy providers that utilize water, wind, solar, and/or fuel cell sources to generate power.	**<u>Strategies:</u>** **<u>BPCA requirements are satisfied for years 1 and 2 by LEED. 3 to 5 year purchase can be at 25% threshold. If tenant purchasing, must be requirement in lease agreement to pursue LEED-CS credit.</u>** **<u>Actions:</u>** **<u>BPCA to advise.</u>**

Likely	Possible	Less Likely	Not Viable			
5	5	1	0	**Materials & Resources**	**Materials & Resources**	

Required		Prereq 1	**Storage & Collection of Recyclables** **Provide an easily accessible area that serves the entire building and is dedicated to the separation, collection and storage of materials for recycling including (at a minimum) paper, corrugated cardboard, glass, plastics and metals.**	3.1 .1 Provide a centralized and easily accessible "Trash & Recycling" room dedicated to the collection, separation, and temporary storage of conventional trash, paper, cardboard, glass, plastics, and metals. .2 Trash & Recycling rooms shall contain either separate waste and recycling disposal chutes, or sorting bins for recycled materials to be managed by the building's recycling plan. .3 Centralized trash/recycling holding areas will be air conditioned, sealed to pests (see § 2.5.2), and maintained within the building. At ground and/or basement levels, these areas shall have convenient access to designated collection points at street.	**Strategies: (1/26/09) - Architects have not designed recycling in yet since they are not sure of the use of the space (could be a banquet space). Either way, rodents are an issue. Tenant will likely want a cafe. IPM plan and construction detailing must address BPCA requirement.** **Actions: Provide sealed, conditioned space within the building for recycling (H3)**
2	1	Credit 1.1-1.3	**Building Reuse -25% (1) Maintain at least 25% of existing building structure and shell (exterior skin and framing excluding window assemblies and non-structural roofing material). (1 pt) -50% (2) Maintain an additional 25% (50% total) of existing building structure and shell (exterior skin and framing excluding window assemblies and non-structural roofing material). (1 pt) -75% (structure & shell) (3) Maintain at least 75% (based on surface area) of**		**Strategies: Structural engineer to determine scope of structural reuse. Architect to determine scope of shell reuse. 2 points likely and 3rd possible under current design. (1/29/09) Although the columns are not directly accounted for in the LEED calculation, BPCA wants to look at reusing the existing columns although it would be more expensive.** **Actions:**

[redacted]		**existing building structure (including structural floor and roof decking) and envelope (exterior skin and framing, excluding window assemblies and non-structural roofing material).**		**<u>Provide SF takeoffs of area reuse at structural slabs, exterior skin (H3, WAI)</u>**
[redacted]	Credit 2.1	**Construction Waste Management** **- Divert 50% from Disposal Develop and implement a waste management plan, quantifying material diversion by goals:** **(1) Recycle and/or salvage at least 50% of construction, demolition (1 point)** **- Divert 75% from Disposal** **(2) Recycle and/or salvage an additional 25% (75% total) of the construction, demolition, and land clearing debris. (1 point) Calculations can be done by weight or volume, but must be consistent throughout.**	3. 2 .1 Before construction commences, develop a Waste Management Plan to be implemented during construction that will divert and recycle a minimum of 80% of waste material by weight. .2 Maintain and submit monthly a Waste Management Log accounting for recycled, diverted, and reused material quantities by weight	**<u>Strategies:</u>** **<u>-(1/29/09) VEE CWM section to supersede original 'Cleaning and Waste Management'. 80% threshold will be used.</u>** **<u>Actions:</u>** **<u>Add requirements to all Bid Packages@ 80% diversion per BPCA (VEE)</u>**

1	Credit 3.1	**Resource Reuse Specify salvaged, refurbished, or reused materials for 1% of building materials. (1 pt)**		**Strategies** **Reused materials can fall into 2 categories: (1) "Fixed" components unable to serve original function (reused are in MRc2) (2) "Finish" material to be kept and refurbished (e.g., Doors and hardware)** **(1/29/09) Interior historic walls will be preserved. Exterior wall plaster will be refurbished. Current CIRs do not address window reuse . 2nd floor is 3/4" to 1" white pine hardwood. 1st floor is concrete. Most ceilings will remain. If tenant can tolerate the interior conditions, they will remain. Otherwise, much of the interior will be replaced.** **Actions:** **Architect to determine extent of reuse (H3) Replace cost avoided must be used to calculate credit compliance (Cost Estimator)**

1 1	Credit 4.1-2	**Recycled Content Use materials with recycled content such that post-consumer and one-half of the post-industrial recycled content constitutes at least: - 10% (post-consumer + 1/2 pre-consumer) 10% of the total value of the materials in the project. (1 point) - 20% (post-consumer + 1/2 pre-consumer) (2) 20% of the total value of the materials in the project. (2 points) The value of the recycled content portion of a material or furnishing shall be determined by dividing the weight of recycled content in the item by the total weight of all material in the item, then multiplying the resulting percentage by the total value of the item. Mechanical, Plumbing, Elevators, and electrical components shall not be included in this calculation. Recycled content materials shall be defined in accordance with the Federal Trade Commission document, Guides for the Use of Environmental Marketing Claims, 16 CFR 260.7 (e), available at www.ftc.gov/bcp/grnrule/guides980427.htm.**	3.3	.1 Use materials with recycled content such that the sum of post-consumer recycled content plus one-half of the pre consumer content constitutes at least 12% of the total value of the materials in the project, excluding mechanical, electrical, and plumbing. The value of the recycled content portion of a material or furnishing shall be determined by dividing the weight of recycled content in the item by the total weight of all material in the item, then multiplying the resulting percentage by the total value of the item. Recycled content materials shall be defined in accordance with the International Organization for Standardization document, ISO 14021 — Environmental labels and declarations — Self-declared environmental claims (Type II environmental labeling). .2 Sum total of recycled content is to include fly ash to replace a minimum of 15% of cement and granulated blast slag to replace a minimum of 25% of cement.	**<u>Strategies:</u>** **<u>Steel components will be required for structural reinforcement. Rebar and other steel will be biggest contributor. An estimate will be coming soon.</u>** **<u>Actions:</u>** **<u>Analyze cost estimate for credit viability (VEE)</u>**
			MR Add 3.2	.1 Use recycled content materials for 20% of the total value of the materials in the project. as defined in § 3.3.	

1 1	Credit 5.1-2	**Local/Regional Materials, 20% Manufactured Locally - 10% Extracted Processed, & Manufactured Regionally Use a minimum of 10% of building materials and products that are harvested and manufactured* within a radius of 500 miles. (1 point) - 20% Extracted Processed, & Manufactured Regionally Use a minimum of 20% of building materials and products that are harvested and manufactured within 500 miles. (1 point)** *** Manufacturing refers to the final assembly of components into the building product that is furnished and installed by the tradesmen. For example, if the hardware comes from Dallas, Texas, the lumber from Vancouver, British Columbia, and the joist is assembled in Kent, Washington; then the location of the final assembly is Kent, Washington.**	3.4	.1 Use a minimum of 50% of all building materials (based on cost), excluding mechanical! electrical, and plumbing, that are extracted, processed, AND manufactured within a 500-mile (air) radius of the project site or 1,000 miles of project site and shipped by rail or water.	**Strategies:** **Structural team suggested dropping regional radius to 250 miles for structural materials. Concrete costs will be high and contribute much.** **Actions:** **Add requirements to specifications (VEE) Structural requirements for structural sections by WAI, review by VEE (WAI)**
1	Credit 6	**Certified Wood Use a minimum of 50% of wood-based materials and products, certified in accordance with the Forest Stewardship Council's Principles and Criteria, for wood building components including, but not limited to, structural framing and general dimensional framing, flooring, finishes, and furnishings.**	3.8	.1 For all wood-based building components installed by the developer, use a minimum of 35% of the total value of all wood-based materials and products certified in accordance with guidelines and criteria decreed by the Forest Stewardship Council (FSC), the Forest Stewardship Program (FSP), the Sustainable Forestry Initiative (FSI), or Green	**Strategies:** **Temporary wood (excluding forms) must be included in BPCA calcs** **Heavy timber framing will stay** **No other limitations to FSC products were defined (i.e. historically appropriate)** **(1/29/09) Structural reports there will be new wood specified to reinforce. The 2nd floor finished floor is integrated to the**

[redacted]		Tag Forestry. Components include, but are not limited to, flooring, finishes, furnishings, and non-rented temporary construction applications (concrete form-work need not be incorporated into this calculation). 3.5 .1 Use best efforts to specify products made with renewable or rapidly renewable materials.	**<u>structure. It may have to be replaced. There are limited damage repairs. They may replace all of the exterior wood trim. Timber shoring will be used.</u>** **<u>Wood costs may be significant. Cost estimates will be used to estimate FSC wood premium when available.</u>** **<u>Actions:</u>** **<u>Use cost estimate to target 50% permanent/ 35% total wood cost as FSC (H3, VEE)</u>**
[redacted]	Other BPCA materials requirements:		
[redacted]		MR Add 3.3 .1 Utilize 2% renewable bio-based materials as defined in the Glossary, for example wheat board, straw board, wool carpet, and bamboo.	**<u>Strategies:</u>** **<u>(1/29/09) BPCA agreed to change this requirement to best effort. The first floor cannot be dry wall because of flood conditions. We may be able to use bio-base materials there.</u>** **<u>Actions:</u>** **<u>Architect to look for opportunities to specify rapidly renewable materials (H3, VEE)</u>**

Likely	Possible	Less Likely	Not Viable					
10	1	0	0	Indoor Environmental Quality		Indoor Environmental Quality		
Required				Prereq 1	**Minimum IAQ Performance** **Meet the minimum requirements of voluntary consensus standard ASHRAE 62- 2004, Ventilation for Acceptable Indoor Air Quality for a complete compilation of Addenda) using the Ventilation Rate Procedure.**	2. 1	1. Ventilation rates: Use ASHRAE 62.2 as the reference standard for indoor air quality performance.	**Strategies:** **Building will be mechanically ventilated with multiple AHUs. Ventilation Rate Procedure calculations will be developed per air handling system and will state system capacities greater than ASHRAE outside air rates are possible for all spaces (including tenant)** **Actions:** **Provide calculations prior to bid issue.**

Required	Prereq 2	**Environmental Tobacco Smoke (ETS) Control** **Zero exposure of non-smokers to ETS by EITHER: a) prohibiting smoking in the public areas of the building and locating any exterior designated smoking areas 25 feet away from entries, outdoor air intakes, and operable windows. Demising walls shall be constructed as impermeable deck-to-deck partitions. The developer is required to provide sealed electrical boxes and switches installed in all demising partitions provided as part of the building core and shell; OR b) providing a designated smoking room designed to effectively contain, capture and remove ETS from the building. At a minimum, the smoking room must be directly exhausted to the outdoors with no recirculation of ETS-containing air to the non-smoking area of the building, enclosed with impermeable deck-to-deck partitions and operated (with doors closed) at a negative pressure compared with the surrounding spaces of at least 5 PA, 0.02 inches of water gauge and min of 1 Pa, 0.004 inches of water gauge.**		**Strategies: The building will be non-smoking** **Actions: Document credit (BPCA)**

1	Credit 1	**Outdoor Air Delivery Monitoring** Install permanent monitoring systems that provide feedback on ventilation system performance to ensure that ventilation systems maintain design minimum ventilation requirements. Configure all monitoring equipment to generate an alarm when the conditions vary by 10% or more from setpoint, via either a building automation system alarm to the building operator or via a visual or audible alert to the building occupants. FOR MECHANICALLY VENTILATED SPACES • For each mechanical ventilation system, provide a direct outdoor airflow measurement device capable of measuring the minimum outdoor airflow rate with an accuracy of plus or minus 15% of the design minimum outdoor air rate, as defined by ASHRAE 62.1-2004.	4.3	.1 Install and maintain a permanent monitoring system or equivalent regular testing protocol that tracks IEQ, measures energy performance of the base building systems and total building energy consumption, and allows operators to make adjustments to maintain targets and confirm the energy model conclusions. See §1.2.3 for details. Provide capacity for ventilation system monitoring to help sustain long-term occupant comfort and well-being. .2 Submit an air quality testing protocol. Provide an Air Quality Profile, prepared by a licensed engineer or certified industrial hygienist, for a sample of 10% of evenly distributed units at time of initial occupancy that meets the following criteria: .a <50 ppb of Formaldehyde .b <200 ?g/m3 total Volatile Organic Compounds	**Strategies:** **Base building systems must have air-flow monitors at each AHU processing outside air (BMS capacity for demand control ventilations). Lease agreement must require CO2 from tenants in all spaces designed to >1 person/40sf. Energy savings may be required from demand control ventilation.** **Actions** **BPCA to follow up with someone to do air quality testing per BPCA requirements (BPCA)** **Design to credit requirements (AKF)** **Add tenant lease language (BPCA)**
1	Credit 2	**Increase Ventilation Effectiveness** For mech. ventilated spaces: increase outdoor air vent. rates to all occupied spaces by at least 30% above minimum rates required by ASHRAE 62.1-2004. For naturally ventilated spaces: Comply w/ CIBSE and provide capability for tenant build-out to meet requirements of this credit.			**Strategies:** **Will likely earn. Ventilation Rate Procedure calcs will show capacities delivered to each tenant space and core areas.** **Actions:** **Provide calcs prior to bid (AKF)**

1	Credit 3	**Construction IAQ Management Plan, During Construction** **Develop and implement an Indoor Air Quality (IAQ) Management Plan for the construction and pre-occupancy phases of the building as follows:** **(1) During construction meet or exceed the recommended Design Approaches of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guideline for Occupied Buildings under Construction, 1995, Chapter 3.** **(2) Protect stored on-site or installed absorptive materials from moisture damage.** **(3) If air handlers must be used during construction, filtration media with a Minimum Efficiency Reporting Value (MERV) of 8 must be used at each return air grill, as determined by ASHRAE 52.2-1999.** **(4) Replace all filtration media immediately prior to occupancy. Filtration media shall have a Minimum Efficiency Reporting Value (MERV) of 8, as determined by ASHRAE 52.2-1999 for media installed at the end of construction.**	2.6	.1 Develop and implement an Indoor Air Quality (IAD) Management Plan for the construction and pre-occupancy phases of the building that meets or exceeds the recommended Design Approaches of the Sheet Meta/ and Air Conditioning National Contractors Association (SMACNA) IA Q Guideline for Occupied Buildings Under Construction. 1995, Chapter 3. The plan shall include the following requirements: .2 Protection of stored on-site or installed absorptive materials from moisture damage: pests, and other forms of contamination. .a Protection of all ductwork during construction and replacement of all filtration media immediately prior to occupancy (see § 2.1.4). .b Monitoring of AD during construction as per SMACNA criteria identified above. .c Implementation of site sanitation and pest-management to be enforced from pre-construction through the end of construction.	**Strategies:** **Requirements to be added to construction bids through specifications. BPCA IPM requirements to be added to demo bid.** **Actions:** **Review specifications for each bid package (VEE)**
0.75	Credit 4.1	**Low-Emitting Materials, Adhesives & Sealants** **Adhesives & Sealants used on the building core and shell must meet or exceed the VOC limits of South Coast Air Quality Management District Rule # 1168 AND Aerosol Adhesives shall comply with Green Seal Standard for Commercial Adhesives**	2.2	.1 "Products applied in the field" (see Glossary definition) shall meet the VOC and chemical component limits of Green Seal (ww.preenseal.orp) requirements or (if no certification criteria are available through Green Seal) the levels set forth in the South Coast Air	**Strategies:** **Preservation products are not specified yet but team does not expect them to violate LEED VOC limits.** **Actions** **Address during spec review (VEE)**

		GS-36 requirements in effect on October 19, 2000.	Quality Management District Rule #1168 (www.aQmd.pov/rules/html/rl 168.html) and the Bay Area Air Quality Management District Regulation 8, Rule 51	
0.7 5	Credit 4.2	**Low-Emitting Materials, Paints & Coatings VOC emissions from interior paints and coatings used on the building core and shell must not exceed the VOC and chemical component limits of Green Seal's Standard GS-11, GC-03, and SCAQMD) Rule 1113, Architectural Coatings, rules in effect on January 1 , 2004.SCAQMD) Rule 1113, Architectural Coatings, rules in effect on January 1, 2004 requirements.**	See 2.2.1	**Strategies:** **Preservation products are not specified yet but team does not expect them to violate LEED VOC limits.** **Actions** **Address during spec review (VEE)**
0.7 5	Credit 4.3	**Low-Emitting Materials, Carpet Carpet systems used in the building core and shell must meet or exceed the Carpet and Rug Institute Green Label Indoor Plus Air Quality Test Program. Carpet adhesive shall meet the requirements of EQ Credit 4.1: VOC limit of 50 g/L.**	2.2.2 Carpet systems installed by the developer must meet or exceed the Carpet & Rug Institute Green Label Plus Indoor Air Quality Test Program.	**Strategies** **Architect must specify limited carpeting to pursue.** **Actions** **Address during spec review (VEE)**
0.7 5	Credit 4.4	**Low-Emitting Materials, Composite Wood & Agrifiber Composite wood or agrifiber products used on the building core and shell must contain no added urea-formaldehyde resins. Laminating adhesives used to fabricate on-site and shop-applied composite wood and agrifiber assemblies shall contain no added urea-formaldehyde resins.**	2.2.3 Prohibit the use of added urea-formaldehyde in composite and wood-based products.	**Strategies** **This is required by BPCA. Composite wood must demonstrate 100% compliance. Cost premium will be incurred for project (10-20%) WAI does not foresee composite structural products.** **Actions** **Assess uses of composite wood and develop appropriate spec alternates (H3,**

[redacted]			**VEE)**
[redacted]	Credit 5 **Indoor Chemical & Pollutant Source Control** **Design to minimize pollutant cross-contamination of regularly occupied areas:** **• Employ permanent entryway systems (grills, grates, etc.), at least 6' long in direction of travel, to capture dirt, particulates, etc. from entering the building at all high volume entryways.** **• Where chemical use occurs (including housekeeping areas and copying/printing rooms), provide segregated areas with deck to deck partitions and self-closing doors with separate outside exhaust at a rate of at least 0.50 cubic feet per minute per square foot, no air re-circulation and maintaining a negative pressure of at least 5 Pa, 0.02 inches of water gauge, on average and 1 Pa ,0.004 inches of water, at a minimum when the doors to the rooms are closed.** **Provide regularly occupied areas of the building with air filtration media prior to occupancy that provides a Minimum Efficiency Reporting Value (MERV) of 13 or better. Filtration should be applied to process both return and outside air that is to be**	2.1 .2 Ventilation distribution: .a Provide a dedicated central outside air system, individually ducted to each tenant. .b Provide ducted ventilation supply air within each tenant space .c Provide ventilation supply air to corridors as per applicable codes, with no exhaust, to maintain positive pressurization .3 Filtration of air Provide a filtering system to filter particle and ozone from the outdoor air. Particle filtration to be provided using filters with Minimum Efficiency Reporting Value (MERV) of at least 13 for exterior air and MERV of at least 10 for interior recirculation units	**Strategies** **BPCA guidelines required excepting 2.1.4 if there is only one tenant. MERV 13 are likely feasible.** **Actions** **Design to credit and BPCA compliance (H3, AKF)**

[redacted]	**delivered as supply air.**		
		~~.4 Airtightness of each (tenant space): Air seal all six sides of each tenant space to 1.25 sq. inches ELA (4pascals) per 100 square feet of enclosure (e.g. exterior walls, walls between apartments, walls between spaces and chases, walls between (tenant space) and corridor, floors/ceilings). Test each (tenant space) via unguarded fan pressurization test (windows open in surrounding units). Figure to be obtained from an average of one pressurization and one depressurization test. Air seal parking garage, boiler room, trash rooms and similar spaces with dedicated ventilation from all other building spaces.~~ ~~.5 Exhaust ventilation: Provide fan powered exhaust for each apartment to equal total outdoor supply air.~~	
		.6 Provide walk-off grilles, capable of being easily removed for maintenance, at the interior of all building entrances to	

				capture potential contaminants and dirt, and to decrease maintenance requirements.	
				.8 Thru-wall heating/cooling systems are prohibited. .9 Do not locate outside air intake ducts in the garage, boiler room, trash room! or similar spaces with dedicated ventilation.	
1	Credit 6	**Controllability of Systems, Thermal Comfort** **1. Provide individual comfort controls for 50% (minimum) of the building occupants to enable adjustments to suit individual task needs and preferences. Operable windows can be used in lieu of comfort controls for occupants of areas that are 20 feet inside of and 10 feet to either side of the operable part of the window.** **AND** **2. Provide comfort system controls for all shared multi-occupant spaces to enable adjustments to suit group needs and preferences. Conditions for thermal comfort are described in ASHRAE Standard 55-2004 to include primary factors of air temperature, radiant temperature, air speed and humidity. Comfort system control, for the purposes of this credit, is defined as the provision of control over at least one primary factors in the occupant's local environment.**	2.3	.1 Provide all apartments with programmable controls for HVAC systems based on a 7-day programmable thermostat with a copy function and four (4) separate programmable periods per day. .2 Provide computerized Building Management Systems (BMS) or equivalent controls for base building operation and monitoring. See § 4.3 for Building Systems Monitoring Requirements.	**Strategies:** **Can be earned by demonstrating base systems have the capacity to provide 50% controls using anticipated tenant interior systems.** **ME to address BPCA thermostatic control requirement.** **USGBC may require tenant lease agreement to earn credit.** **Actions:** **Evaluate design in DD (VEE, AKF)**

			2.1.7 Provide humidity stabilization throughout the year to all occupied building spaces. Provide a benchmark 68° F 30% RH in winter and 76° F 50% RH in summer. Humidification during heating periods may be reduced when ambient conditions fall below ASHRAE 99% design conditions (i.e. below 15° F in NYC).	
1	Credit 7	**Thermal Comfort, Design Design HVAC systems and the building envelope to meet the requirements if ASHRAE Standard 55-2204, Thermal Comfort Conditions for Human Occupancy.**		**Strategies** **There will be a winter humidification system. DIA center will likely require a narrow window of interior conditions. Typical mechanical systems can demonstrate compliance.** **Actions:** **Design to 2004 conditions. Identify if exhibit space restrictions jeopardize credit (AKF)**
1	Credit 8.1	**Daylight & Views, Daylight 75% of Spaces OPTION 1 — GLAZING FACTOR CALCULATIONS Achieve a minimum glazing factor of 2% in a minimum of 75% of all regularly occupied areas. The glazing factor is calculated as follows: Glazing Factor = [Window area (SF) / Floor area (SF)] x Window Geometry Factor x [(Actual Tvis / Minimum Tvis)] x Window Height Factor**	2.4.1 Increase natural light in habitable rooms	**Strategies** **Will likely earn with window layout and thin floor plates** **Actions** **Confirm through calculations**

Likely	Possible	Less Likely	Not Viable				
1				Credit 8.2	**Daylight & Views, Views for 90% of Spaces** **Achieve direct line of sight to vision glazing for building occupants in 90% of all regularly occupied spaces. Examples of exceptions include copy rooms, storage areas, mechanical, laundry and other low occupancy support areas. Other exceptions will be considered on their merits.**		**Strategies** **Will likely earn with window layout and thin floor plates** **Actions** **Confirm through calculations**
3	2	0	0	**Innovation & Design Process**		**Innovation & Design Process**	
1				Credit 1.1	**Innovation in Design: Integrated Pest Management and Green Cleaning**	2.5 .1 The developer shall prepare and implement an Integrated Pest Management Plan (IPMP) that abides by the requirements outlined in this section and § 2.1 (IAQ). .2 Properly seal, caulk, and repair points of entry, habitation, and breeding areas to mitigate against pest occurrences within the building. Use metal sheeting or mesh whenever possible. .3 In all apartment kitchens, provide an in-	**Strategies** **BPCA requirements are both construction and O&M. By meeting, project will earn ID credit.** **Actions** **Require IPM plan during construction through specifications (H3, VEE)** **Develop O&M plan (BPCA)**

[redacted]		sink garbage disposal unit that is compatible with the building's water reclamation system.	
[redacted]		•Properly seal all penetrations (ia around water pipes, (cont.) steam risers, electrical conduits, etc.) with copper mesh, metal sheeting, or concrete. Use caulking and plaster only as a last resort. • Properly assemble trash chute sections so that garbage bags do not catch and rip on their way down. • Encourage tenants to properly seal and bag garbage in the Tenant Guide • Caulk every joint within and between cabinets, over exposed screw heads! and within the cabinet structure. Properly seal cracks and joints at tile floor/wall joints and cavities, baseboard/wall interfaces, and window frame/wall interfaces. • Provide properly fitting door sweeps at all exterior doors and hallway doors — undercut exterior doors with less than ? inch clearance and provide vinyl or brush sweeps. • Cover all ventilation portals with insect mesh (metal	

				window screen) and ? inch wire mesh (hardware cloth). Ensure easy access to portals and frequent cleaning. • Encourage prompt repair of leaky faucets, condensation on pipes, or other unwanted sources of water.	
1	Credit 1.2	**Innovation in Design: Educational Outreach**	4.1	.1 The developer shall provide "green construction practices" training to key on-site construction management, sub-contractors, and personnel. Submit course outline to BPCA for review and provide visible recognition for those who participate, such as stickers on hard hats. It a member of personnel has been previously trained in a similar project, provide proof to BPCA of course scope and completion. .2 The developer shall employ a Green Team Leader to manage recordkeeping and educational	Strategies By meeting BPCA requirements, project will earn ID credit. Actions 2 of the following 3 must be pursued: 1) A comprehensive signage program built into the building's spaces to educate the occupants and visitors of the benefits of green buildings. (H3, BPCA) 2) The development of a manual, guideline or case study to inform the design of other buildings based on the successes of this project. (H3, BPCA) 3) An educational outreach program or

			mandates set forth in these guidelines. .3 The developer shall develop and maintain a comprehensive Tenant Guide and make it available to tenants in print form at lease signing and on-line for continuous updating. .5 In the lobby area, a bulletin board or web screen (minimum 2'x3') shall be prominently located for posting energy/environmental education information, including yearly (and, if possible, monthly) building energy performance reports comparing to benchmarks/peers This information shall also be displayed on-line.	guided tour to focus on sustainable living, using the project as an example. (H3, BPCA)
1	Credi t 1.3	**Innovation in Design: Water Use Reduction**		**Strategies: Expected fixture types & rainwater reuse should top 40%** **Actions: Document (H3, VEE)**
1	Credi t 1.4	**Innovation in Design: Historic Preservation**	Intent: Preserve cultural heritage and support sustainable development: less disruption to the site and neighborhood, conservation of materials, reduced extraction of new materials, the indoor quality of historic approaches to low-toxic finishes, natural daylighting and operable windows. Submittals: - Narrative describing the reuse of a historic building - Description of cultural and environmental benefits	**Strategies: this could include structural aspect. Replacement pier deck avoided demo deck and shoring.** **Actions: TBD**

1				Credit 2	LEED™ Accredited Professional		
35	17	2	5	**Project Totals**			

Certified 23–27 points Silver 28–33 points Gold 34–44 points Platinum 45–61 points

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