

Innovation in Upgrades, Operations & Maintenance (IUOM)

Credit 1.2

Biophilic Connection

Description of Achievement

E & E's Headquarters Building provides a connection to the natural world through the use of indoor plantings, the use of natural and local materials, proximity to animals, or other biophilic design attributes.

The designs of Frank Lloyd Wright, several of which can be seen here in Western New York, provided the inspiration for E & E's Headquarters. Wright's designs are characterized by a distinctive harmony with nature. They blend with their surroundings and bring in the outdoors by incorporating natural themes, patterns, and ornament.

The Managed Landscape

"Inside Out – Outside In, the Environment and Building are One"

— *Frank Lloyd Wright*

It is fitting that E & E chose to emulate the Frank Lloyd Wright approach for the design and management of its Headquarters Building. The structural design is in harmony with the interior and exterior landscapes. Biological function and value are evident throughout the complex.

Environmental Benefits

Human beings need to feel connected to the natural environment to promote a sense of psychological, physical and social well being. Biophilia directly confronts the issue of aesthetics and our evolved sense of beauty. The patterns, forms, textures and colors of nature provide abundant models that can be used in building and product design to enhance their aesthetic appeal, not just their functionality and efficiency. Incorporating this natural sense of beauty into our buildings will make them not only greener in the environmental sense, but also greener in a human sense. Buildings in natural areas can provide outdoor trails and eating areas, as well as views to the landscape from spaces throughout the building.

Since the majority of our time is spent indoors, views to the outside provide a relaxing and calming effect in an increasingly stressful and complex world. Studies have consistently found stress reducing and health promoting outcomes associated with passive viewing of nature scenes through windows. A view to the outdoors is an important consideration when placing buildings on the site and positioning rooms in the building. The size of a view window should be proportional to the depth of a room in order to provide an adequate view from a deep room. Outdoor views will be maximized to the extent possible in buildings such as schools, hospitals, retail spaces, unsecure office spaces, and housing. Designing for views is closely linked with daylighting. It has been demonstrated that the incorporation of daylighting into interior spaces increases worker productivity, improves attentiveness and learning ability in school children, and shortens recuperation time for patients, as well as lowering energy costs.

This is the essence of biophilic design.

“When we designed the building, we wanted everyone to have natural sunlight. With the large atrium, it was decided that all the interior offices would be open so the sunlight could enter. We used sunlight like Frank Lloyd Wright did, with the soffits lining the hallways, to give the nice glow of the sun. With over a thousand plants in the building, the air is fresh. The air circulation was designed so that in every room the windows can be opened.”

According to the Rocky Mountain Institute (<http://www.rmi.org/sitepages/pid1079.php>), biophilic design attributes include:

- the use of dynamic and diffuse daylight,
- the ability to have frequent, spontaneous and repeated contact with nature throughout and between buildings,
- the use of local, natural materials,
- a connection between interior and exterior surfaces,
- natural ventilation,
- a direct physical connection to nature from interior spaces, and
- direct visual access to nature from interior spaces.

E & E’s Headquarters incorporates all of these design elements; however, the most dramatic and obvious feature of the building is its two-story atrium and vast indoor landscape (see attached **Photolog: Photos 1 thru 6**). A 300-foot-long, two-story atrium topped by motor-operating skylights runs down the building’s interior along the long axis. The atrium floor contains open, in-floor planter areas housing full-size trees and other plant species and numerous containers. The second-floor atrium level is ringed with planter boxes containing a variety of upright and hanging species. Floor plans showing the locations of the atrium planters are attached. The E & E atrium garden features a collection of plant species from the world’s tropical and subtropical regions, including:

E & E Corporate Center Atrium Plant List (partial)

<i>Ficus benjamina</i>	Indian Laurel
<i>Epipremnum aureum</i>	Devil’s Ivy (Pothos)
<i>Beaucarnia recrvata</i>	Ponytail Palm
<i>Brassaia actinophylla (Schefflera)</i>	Umbrella Tree
<i>Strelitzia reginae</i>	Bird-of-paradise
<i>Nephrolepis exaltata</i>	Boston Fern, Sword Fern
<i>Zygocactus truncatus</i>	Christmas Cactus, Crab Cactus
<i>Polyscias fruticosa 'Elegans'</i>	Parsley Aralia
<i>Asparagus densiflorus 'Meyers'</i>	Plume Asparagus
<i>Araucaria heterophylla</i>	Norfolk Island Pine
<i>Sansevieria trifasciata 'Laurenti'</i>	Snake Plant, Mother-In-Law's Tongue

<i>Polyscias fruticosa</i>	Ming Aralia
<i>Clivia miniata</i>	Kafir Lily
<i>Crassula argentea</i>	Jade Plant
<i>Hoya carnosa</i>	Wax Plant
<i>Bougainvillea glabra</i>	Paper Flower
<i>Spathiphyllum sp</i>	Peace Lily
<i>Euphorbia tirucali</i>	Pencil Tree Cactus
<i>Aloe sp</i>	Aloe

A collection of uncommon species of cactus and succulents can be found on window sills and along window walls throughout the facility. Low maintenance, slow growing species were selected for these locations to provide visual contrast for birds to avoid collisions with windows.

This listing includes those indoor plants which are most abundant, most useful for indoor air quality, or of special interest; it is not a complete listing of all of the species which can be found within the Headquarters building. The dominant species (pothos, or devil's ivy) growing in the second-floor planter boxes along both sides of the atrium was selected for its superior ability to release oxygen, filter air impurities, and uptake carbon dioxide during photosynthesis.

It is recognized that plants in the workplace offer more than aesthetic value. In fact, studies have shown they help reduce stress, enhance employee attitudes, increase productivity, and improve air quality. The following information was obtained from www.plantsatwork.org:

(1) Plants offer a means to decrease stress while enhancing productivity by 12%

It is widely known through the respected research done by Dr. Roger S. Ulrich of Texas A&M University, Helen Russell, Surrey University, England as well as the recent studies conducted by Dr. Virginia Lohr of Washington State University that plants significantly lower workplace stress and enhances productivity. Additionally, during an 8-month study at Texas A&M University, both men and women demonstrated more innovative thinking, generating more ideas, and original solutions to problems in an office environment that included plants and flowers.

(2) Interior plants lower O&M (Operations and Maintenance) costs while contributing to 'Green Building' design considerations.

Plants cool by a process called transpiration, which, according to the U.S. Department of Agriculture, decreases air temperature in offices by ten degrees. A recent study out of Washington State University demonstrates that plant transpiration in an office environment releases moisture, creating a humidity level exactly matching the recommended human comfort range of 30-60%. Similarly, the same study concludes that in an absence of plants, the relative humidity in offices runs below this recommended range. When the relative humidity of office air is too low, costly materials such as wood become damaged and crack. When the relative humidity is too high the condensation of windows and exterior walls can result in costly structural damage.

According to the International Society of Arboriculture, the net cooling effect of one young, healthy tree is equivalent to ten room-size air conditioners operating 20- hours a day. According to literature from the Associated Landscape Contractors of America, proper selection and placement of plant materials can lower heating and cooling costs by as much as 20%.

(3) Plants in the workplace attract, retain and enhance attitude of today's selective employee.

Gallop polls indicate that two thirds of the American working force-cite gardening as their favorite hobby. Perhaps this "green thumb" passion explains why humanizing the workplace with green plants is a highly effective method to promote employee satisfaction. Copious studies such as those conducted by Dr. Ulrich and Dr. David Uzzell from Oxford University verify the positive effect plants have on employee perception and disposition.

(4) The dramatic aesthetic value inherent in indoor landscaping has continued to be the number one return on interior plant investments.

Indoor plants continue to cost less than most alternative corporate decor choices, they offer a guarantee of positively enhancing perception and contributing to well being. The same set of studies conclude that people (clients or employees) perceive a building with interior planting as more expensive- looking, more welcoming and more relaxed.

(5) It's finally possible to have an energy efficient building without "Sick Building Syndrome!" Plants help with bottom line savings on mounting sick leave expenses.

Research shows that plant-filled rooms contain 50-60% fewer airborne molds and bacteria than rooms without plants. The plants clean contaminated office air in two ways. They absorb office pollutants into their leaves and transmit the toxins to their roots, where they are transformed into a source of food for the plant.

(6) Plants help reduce distractions due to office noise.

Strategically placed, plants quiet down an office. A small indoor hedge placed around a workspace will reduce noise by 5 decibels. The positive contribution of interior plants to sound absorption has been well documented in numerous studies including the work done by Dr. Helen Russell, Oxford, England and David Uzzell, University of Surrey, England.

The atrium not only supports the vast indoor landscape in the E & E Headquarters building, but allows for the introduction of abundant daylight and fresh air. Use of the atrium is dependent on a number of parameters including the evening and daytime forecasted temperatures, relative humidity inside and outside, wind conditions, and time of day. In 2006, the atrium was opened an estimated 35 days (depending on actual weather conditions the atrium could have been open anywhere from a few hours to all day). Employees are notified via email when the atrium has been open/closed so that nearby windows can be opened/closed accordingly. The many operable windows in the building (as documented in *Credit EQ 6.2*) also provide additional daylight and views to the outside. E & E's exterior landscape supports a wide variety of plants and wildlife

including deer, hawks, wild turkeys, fox, and over 160 species of birds that can be seen regularly from within the building (see attached **Photolog: Photos 8 thru 14**). Additional information on E & E's Wildlife Preserve can be found under *Credit IUOM 1.3*. Daylight and views are further documented in *Credits EQ 8.1 thru 8.4*.

Nature is used as ornament both on and within the building. The exterior brick walls of the building are interspersed with terra-cotta medallions commemorating native plant and animal species. Similar medallions ornament the internal atrium space (see attached **Photolog: Photos 6 & 7**). The building interior was constructed using local, natural materials such as brick, wood, glass, and ceramic tiles. There is no plastic and vinyl used on the building, either inside or outside. Additionally, there is an outdoor patio with tables accessible to all employees for use during lunchtime, breaks, and informal meetings that is nestled within the outdoor landscape.

Performance Metrics

There is no way to truly measure the impact these biophilic design elements have on the productivity of employees working in the building; however, the following quotes are from E & E employees obtained during a recent survey on the impact of the building on their performance (see *Credit EQ 4.2* for additional information on building survey):

“The environment definitely contributes to my productivity. For example, the day I found out that the bird of paradise bloomed in the lower horseshoe I was in a great mood, hence, I had a great work day.”

“I am fortunate enough to sit under the atrium, which I enjoy tremendously. Natural sunlight, green foliage and a fresh breeze (with an open atrium) in the summer time makes me feel like I'm working outside. Having worked in other offices without these features makes one appreciate how these design features can improve my outlook at work.”

“I am new here, and very much enjoyed seeing fox and deer out the window on my way to the copy machine my first week. I also enjoy looking at the trees in the atrium with the light filtering through the leaves, and opening windows for fresh air. It is a wonderful work space.”

“You can't go anywhere in this building without seeing the outside. That is so much better than seeing walls.”

“I enjoy being able to look outside during a stressful day and view the trees, birds and other wildlife in our backyard. This is definitely a stress reducer.”

“Every job will have a level of stress associated with it. The natural environment of the E&E building, especially the sunlight (and sometimes fresh air) from the atrium and the views of numerous wildlife and attractive scenery outside, offer some built-in stress reduction. It's a pleasure to work in a natural-friendly building and environment.”

E & E's Headquarters building was designed and constructed over 20 years ago incorporating the principles discussed above. There were no design changes or modifications made to the building as a result of attempting to get a LEED rating; therefore, there are no additional benefits delivered over the performance period as compared to any time before or after that period. Certain performance metrics, such as the energy savings resulting from the liberal amount of daylight in the building and the ability to utilize natural ventilation, can be measured (see *Credit EA 1*); however, the benefits provided by the smell of a Plumeria flower blooming in the atrium or the sighting of baby ducklings in the exterior planters or of a rare bird can only be felt by the individual and described, to the best of our ability, in words.