


Building Green for the Future

Case Studies of Sustainable Development in Michigan

Urban Catalyst Associates

"The principles of green building, whether part of LEED certification process or independently undertaken, make good economic sense for all parties involved."

- Greg Markvluwer
Herman Miller
case study, pg 36

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Ann Arbor, Michigan

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"There is no better atmosphere in which to promote and create sustainable architectural solutions than a school. Forest Hills Eastern High School embraces these solutions in Western Michigan."

- J. Michael Washburn,
Superintendent
Forest Hills case study, pg 62

Executive Summary

Green buildings use resources–energy, water, materials, and land–more efficiently and effectively than buildings that are simply built to code. Green developers and builders create healthier working, learning, and living environments with more natural light and cleaner air. Working and living in such buildings improves occupant health, comfort, and productivity. By building green, developers save money by reducing construction costs and creating sustainable buildings that are in high demand. Owners save money by reducing operation and maintenance costs, lowering utility bills, and increasing occupant productivity.

In Michigan and elsewhere, common misperceptions persist, claiming that green buildings cost more than traditional ones and that there is no market for them. Some people think that green buildings will not "work" in Michigan.

This Michigan-specific handbook dispels these misperceptions and demonstrates that the cost premium for green buildings is minimal. Many green buildings cost less in the long-term and help create healthier social and natural environments. Green development has thrived in Michigan for over a decade now, as is evident from the case studies included in this handbook.

Over the last few years, the green building movement has gained momentum and attention nationally and now in the state of Michigan. The United States Green Building Council (USGBC), a national non-profit organization, has grown dramatically in membership and its Leadership in Energy and Environmental Design (LEED) rating system has been adopted nationally and internationally as the de facto green building standard.

Positive consensus is almost universal on the environmental and social benefits of green buildings. Lately, consensus is emerging on the financial benefits of green buildings as well. Published studies emphasize that capital costs for these buildings range from significantly less than to slightly more than comparable buildings, with an average premium of 2% (Source: The Costs and Benefits of Green Buildings). As the number of green building projects continues to rise, costs will continue to drop, and this modest premium will likely evaporate.

The notion that green buildings cost significantly more than traditional buildings is due to the learning curve with regard to sustainable technologies, and an imprecise definition of green buildings. Costs for green buildings continue to decrease as materials become standard and practitioners become more proficient in new technologies. Perceptions of "green" also are changing: people are realizing that sustainable technologies need not be exotic or expensive, and green buildings need not be visibly different than other buildings unless so desired. Green buildings are simply products of intelligent, integrated design that meet or surpass the requirements of any standard development project.

The market in Michigan has begun to realize the real financial benefits of these projects, and the environmental and social benefits highlight developers' and owners' concerns for their employees and society at large. The state of Michigan stands at the forefront in developing green buildings and continues to develop resources and support for green building activities. Michigan ranks eighth nationally for green development projects in progress and sixth nationally for LEED-certified projects (Source: USGBC LEED registered and certified projects).

Throughout Michigan, private developers, public companies, government agencies, and educational institutions are adopting green building practices. The case studies in this handbook highlight examples from across the state, demonstrating how different organizations and agencies plan, design, and benefit from green buildings.

"We made natural features marketing tools. And we're proving that using these concepts can help sell houses faster."

- Mick McGraw

Bailey's Grove case study, pg 82

Table of Contents

Case Study Matrix

		COMMERCIAL			EDUCATIONAL			RESIDENTIAL			INSTITUTIONAL	
		Helmus Building *Grand Rapids*	Herman Miller MarketPlace *Zeeland*	East Hills Center *Grand Rapids*	Everett Marshall Building *Ypsilanti*	Zeeland West High School *Zeeland*	Forest Hills High School *Ada*	Green Built Demonstration Home *Grand Rapids*	IHM Motherhouse *Monroe*	Bailey's Grove *Kentwood*	Malletts Creek Branch Library *Ann Arbor*	DEQ Southeast Michigan District Office *Warren*
	Page Number	30	36	42	50	56	62	76	70	82	90	96
Key Topics	Brownfield Redevelopment			●								●
	Stormwater Management			●		●				●	●	●
	Materials Use	●	●	●	●		●	●	●		●	●
	Energy Efficiency	●	●		●	●	●	●	●		●	●
	Water Efficiency						●	●	●	●		●
	Social Benefits	●	●	●	●		●		●	●	●	
	Development Processes		●				●	●	●	●	●	●
	Cost-Benefit Analysis		●				●	●				
	Funding Sources			●	●	●					●	
Benefits of Green Development	Reduced Capital Costs	●	●			●	●			●		●
	Lower Operating Costs	●	●	●		●	●	●	●		●	●
	Reduced Risks & Liabilities		●	●				●		●		
	Less Environmental Impact	●	●	●	●	●	●	●	●	●	●	●
	Healthier Indoor Environment and Improved Productivity	●	●		●		●	●	●		●	●
	Stronger Social Networks	●		●	●		●		●	●	●	
	Increased Environmental Awareness		●		●	●	●		●	●	●	●
Costs	Under $1 million			●				●				
	$1 million - $10 million	●									●	
	$10 million - $50 million				●	●	●					
	Over $50 million		●						●	●		

User's Guide to Building Green for the Future

Building Green for the Future was designed to be a starting point to help interested parties learn more about green design and sustainability in Michigan. Each case study may not be directly applicable to all your projects, but several learning points from individual cases are widely applicable.

The cases in this handbook were chosen because we found them to be inspirational and demonstrate how practical and approachable green and sustainable development can be. Hopefully this handbook will evoke greater thought, discussion, and eventual green building activities and projects. We firmly believe that if the people featured in this handbook succeeded in green building projects, you will too!

This handbook recognizes that readers' interests and background knowledge will vary and is therefore not meant to be read cover-to-cover – although it is certainly possible and worthwhile. Rather, it is meant as a reference tool on the subject of green development, with the case studies serving as prime examples. The following elements will optimize your time and learning:

Segmentation of Learning Objectives

This handbook is divided into two complementary sections:

- The fact-based and practical application section includes detailed information about the economic, social, and health benefits of green buildings; the importance of integrated design; and the existing market for green buildings.
- The Michigan-specific case study section shares the unique stories behind each green building project. These detailed cases highlight the benefits and practical applications defined in the first section.

Case Study Matrix

Located on pages 6 and 27, the matrix identifies cases by specific topic and area of interest.

Green Development Spectrum

On page 16, the Green Development Spectrum conceptually presents examples of green development, ranging from simple actions with short payback periods to more intricate actions requiring longer investment time horizons. The examples also indicate which of the cases demonstrate each action.

Case Order

The case studies are grouped by category–commercial, educational, residential, and institutional–to help you find the cases most relevant to you.

Consistent Case Study Format

A standard design template is used for all the cases, making it easy to move between the case studies, identify areas of interest, and make comparisons.

Resources and Contact Information

This handbook is intended to help expand your green development network. Wherever possible, additional resource information within the cases is provided on products and services, as well as contact information for the developers, architects, and owners of the projects covered.

Terms Easily Referenced and Defined

With such a wide audience for this handbook, individual levels of understanding and knowledge will vary. For this reason, the handbook highlights in red and defines those terms that may be unfamiliar to some readers.

"You can only
be as green as your
client lets you be."
- Shannan Gibb-Randall
Malletts Creek case study, pg 90

The Benefits of Green Development

Green Development. Environmental Design. Green Buildings. Sustainable Development. High-Performance Buildings. These terms refer to the same fundamental concept: improving the built environment while minimizing the impact on the natural environment. The array of terms is necessary, in that each has a slightly different connotation; in this handbook a wide, but selective, set of terms is used to best describe the projects that are showcased.

Sustainable Development

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

Source: World Commission on Environment and Development (The Brundtland Commission), 1987, Our Common Future, Oxford: Oxford University Press.

In the last 15 years, green development has evolved and spread significantly. Nowadays, sustainable forest products, low-VOC paints and adhesives, energy-efficient lighting, and recycled carpeting are standard construction and renovation materials. Committed industry practitioners continue to refer to their feelings of responsibility and their desire to "do the right thing"; however, the emphasis on the economics of environmentally conscious decisions has become increasingly important as these practices make their way into the mainstream. Recent studies indicate that the economic benefits have been substantiated; more and more the focus is on demonstrating the financial benefits of these products and practices as well as highlighting the environmental benefits.

The benefits of these buildings are many and, for this discussion, have been grouped into three categories– financial, environmental, and social (see table to right). These benefits are impressive and studies show that they are optimized when the developers and owners begin thinking green from the outset of the project, lowering costs by reducing the need to retrofit or tack on sustainable components to the project later on. In this handbook, this integrated design approach is examined, by highlighting case studies that detail the benefits. Real examples of the following benefits are highlighted throughout the case studies. On page 6, the case matrix visually highlights the benefits and points you towards the appropriate cases.

Financial Benefit #1: Green buildings reduce capital costs.

- Reusing portions of existing structures, when possible, significantly reduces construction material costs and the amount of waste sent to landfills.
- Maximum use of natural daylight reduces the number and size of lighting fixtures required.
- Smaller, less expensive mechanical systems are used when buildings are designed with energy efficiency in mind. (Helmus Building pg 30)
- Minimizing impervious surfaces reduces stormwater handling and the need for traditional paving materials. (Malletts Creek Library pg 90)
- Materials from demolition are recycled, creating new sources of revenue from the sale of salvageable materials and diverting waste streams from the landfill. (IHM Motherhouse pg 70)

Benefits of Green Development

Financial
1. Reduced capital costs
2. Lower operating and maintenance costs
3. Reduced risks and liabilities

Environmental
1. Less impact on the natural environment
2. Healthy environments and improved productivity

Social
1. Stronger social networks
2. Increased environmental awareness

Source: Urban Catalyst Associates

Financial Benefit #2: High performance buildings reduce operating and maintenance costs.

- High efficiency water fixtures dramatically cut water consumption levels. Additionally, graywater systems filter and reuse water (in toilets and for landscaping) that otherwise flows into the sewer system. (Malletts Creek Library pg 90)
- Fewer light fixtures and the use of motion sensors and timing devices decreases energy consumption. Also, installing compact fluorescent light bulbs which last longer, means fewer bulb changes.
- Increased use of daylight improves employee morale and reduces energy operating costs. (Herman Miller pg 36)
- Healthier buildings mean less employee sick time and higher productivity, thus lower operating costs. (Herman Miller pg 36)
- Structures designed to take advantage of passive heating and cooling minimize wear on HVAC systems and consistent indoor temperatures reduce HVAC demands and energy consumption.
- Longer lasting equipment and more efficient systems result in lower maintenance costs. (Forest Hills pg 62)
- Green flooring materials (such as renewable, recyclable cork) last for decades, requiring little to no maintenance beyond cleaning. (IHM Motherhouse pg 70)
- Light colored roofs or green roofs reduce cooling energy needs in the summer months. (Malletts Creek Library pg 90)

"Five years ago, the cost of green building came at a higher premium, but now a lot of green products are comparable [in price] with traditional products."

Lynn Rogien
Everett Marshall Building Case Study pg 50

Financial Benefit #3: Sustainable buildings result in lower risks and liabilities.

- Projects with demonstrable social and environmental benefits enjoy the support of the public, and thereby help in avoiding roadblocks to securing government approval and minimize the holding costs of real property. (Bailey's Grove pg 82)
- Incorporating innovative materials and systems into a project staves off future expenditures related to compliance with new regulations (e.g., energy codes). (Zeeland High School pg 56)
- Energy and water efficient structures make buildings less vulnerable to fluctuations in utility prices and better able to deal with temporary service disruptions.
- Improved ventilation reduces toxics and molds that contribute to sick building syndrome.
- Native plants do not require the herbicide and pesticide applications that can contaminate the groundwater or be harmful to building occupants. (Malletts Creek Library pg 90)

Environmental Benefit #1: Green buildings reduce the impact on the natural environment.

- Reuse of land for an infill development project reduces the impact of additional roads and sewers on the environment and promotes walking and transit use. (East Hills Center pg 42)
- Conscientious construction methods divert tons of waste materials from landfills and minimize site disturbance.
- Informed choice of building materials reduces the demand on natural resources and can improve the quality of the building.
- Stormwater reuse reduces the demand for potable water and municipal groundwater withdrawals.
- Smart growth helps protect green and open spaces as well as reduce sprawl which results in occupants not commuting as far, in turn reducing vehicle emissions. (Bailey's Grove pg 82)
- The use of renewable wood and recycled content materials is encouraged.
- Reduced energy consumption means fewer power plant emissions.

Environmental Benefit #2: Healthier working and living spaces improve occupant productivity.

- Maximizing the use of natural light leads to significant gains in productivity, increases retail sales, and creates better learning environments for students. (Forest Hills HS pg 62)
- Interior finishing materials minimize the release of VOCs, improve indoor air quality and increase productivity as users feel more comfortable in their new surroundings and have fewer sick days. (Everett Marshall Building pg 50)
- Even minor changes to the indoor environment of a building, such as individual heating and lighting controls or operable window sashes, improve comfort and productivity in workspaces, thus boosting morale.

Social Benefit #1: Sustainable buildings foster stronger social networks.

- Infill development of sustainable buildings prevents resources from leaving communities and revitalizes neighborhoods and districts. (East Hills Center pg 42)
- Local transportation of materials reduces air emissions and petroleum consumption, therefore reducing our dependence on foreign oil as well. (Warren DEQ pg 96)
- Redeveloped abandoned buildings become attractive anchors in communities and encourage additional improvements that repair vital urban fabric of long-neglected cities and towns. (East Hills Center pg 42)
- Locally produced and purchased materials sustain the community and resulting decreased transportation costs yield financial as well as environmental benefits.

Social Benefit #2: Environmentally responsible development increases environmental awareness.

- Outdoor signs, interior displays, guided tours, and the presence of unusual building features pique the curiosity of the public and expand their understanding of our relationship and responsibility to the natural environment. (Everett Marshall Building pg 50)
- Individuals who learn about green building principles and sustainable behaviors apply these practices to their lives, spreading the impact of a single green development project through other communities. (IHM Motherhouse pg 70)
- Construction trades and other industries may apply the innovative practices learned in a sustainable building project to their future work on other projects.

Everett Marshall Building case study pg 50

Green Development Perceptions and Realities

The practice of green development is spreading rapidly through the state of Michigan and the nation. However, misperceptions still prevent some projects from maximizing financial, environmental, and social benefits. The following are some of the most common misperceptions regarding green building.

Perception

The high costs of green development are not financially feasible.

Reality

Over the life of a sustainable building, net costs are typically lower than traditional development, primarily through energy savings. In many green projects, the productivity gains more than repay any increase in capital costs. In fact, often a green building will pay for itself sooner than a traditional structure. A key factor in cost effective green development is integrating sustainability into the project from the outset, designing from the start a green project, rather than tacking on green elements to a traditional building. In any given project, integrating sustainability leads to lower capital costs. In the end, sustainable development is not about spending money to be "green." Simply, sustainable green development saves money. More information about the economics of green building is located on pg 14-15.

Perception

Green building materials are not the same quality as traditional materials, are not readily available, and it is difficult to find contractors who know how to use them.

Reality

Green products are usually just as durable as non-green ones; for certifications such as Green Seal (www.greenseal.org), it is required that a green product perform at least as well as any comparable non-green product on the market. In some cases, specific "green" products are unnecessary for a project; one can use traditional materials in a sustainable manner through an integrated design approach that considers building operation. For example, spacing the lights farther apart near exterior windows to take advantage of sunlight or using motion sensors on restroom lights requires no new technology, just commonsense design. As for contractors, they typically do not need special training to work with sustainable products, and to the extent that they may, manufacturers can suggest contractors familiar with their products. The cases in this handbook list some websites for green building materials used in the various projects.

Perception

Green development would be easier if the demand were greater.

Reality

Demand for green development projects is growing rapidly and the building industry is accumulating data on the benefits of green practices. As it becomes clearer that this is not unusual or extreme design, and the extensive benefits of green development become more widely known, the demand will continue to grow. In some cases, the solution to perceived soft demand is repositioning green development to better highlight the efficiency, lower costs, and improved health and productivity gains of a sustainable project (hence, the term "high performance buildings"). More information about green building demand is located on pg 20-22.

Perception

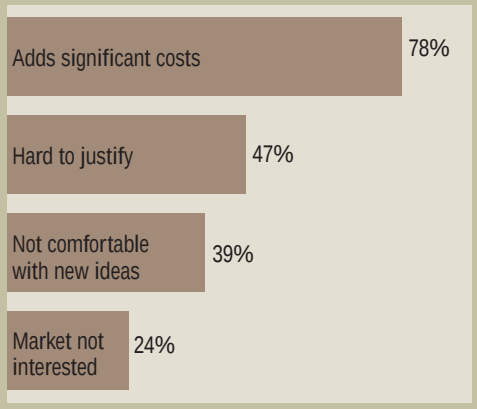
Creating sustainable buildings is too large a commitment.

Reality

Each case in this handbook demonstrates that green and sustainable design is indeed feasible. On page16, the Green Development Spectrum demonstrates that green development practices can range from simple to more intricate. In addition to the resources provided in this handbook, the Michigan Department of Environmental Quality (DEQ) maintains extensive resources to help anyone incorporate green concepts into any facility, from residential to commercial. These can be found at their website: www.michigan.gov/deqconstruction.

Perceived Barriers to Sustainable Design

(The Insiders Guide to Marketing Green Buildings, Yudelson 2004)



The Economic Case for Green Buildings

The largest obstacle facing the development of sustainable buildings is the perception that construction costs are higher. Some aspects of green buildings can cost incrementally more to build, but over the lifetime of the building these costs are more than recouped. In "Green Building Costs and Financial Benefits," Gregory Kats calculated that a premium is paid for LEED-certified buildings in the construction phase, but (1) the premium is not as costly as many believe, and (2) these costs are recouped over a short period and lead to future savings.

Kats and his team studied 40 LEED buildings, all of them offices and schools; the two Platinum-certified buildings came in at a 6.8% premium, the nine Gold buildings averaged a 2.2% premium, the 21 Silver buildings averaged 1.9%, and the eight Certified buildings averaged 0.7%. Kats also pointed out that developers can avoid these premiums with proper planning and integrated design (see pg 18). Furthermore, over a 20-year period, savings from energy efficiency, emissions reductions, water savings, reduced operations and maintenance costs, and improved productivity, these buildings clearly hold a positive net present value (NPV). The NPV box on pg 15 explains how to calculate a NPV and the chart on pg 15 represents Kats' calculation of NPV for a typical green building.

The key to developing and selling green buildings is to identify and articulate the benefits, as Kats has done in his example. Proving this economic case requires making clients comfortable with two concepts: (1) that the present value of lifetime economic benefits (like those resulting from greater efficiency) can be calculated, captured, and recouped, and (2) that dollar values can be assessed on the less tangible benefits such as increased employee productivity and improved learning environments for students.

To better explain these concepts to clients, it may be helpful to compare investments in green projects to investing in the stock market. For example, a payback on an investment in energy efficient light fixtures or a white roof is typically in less than three years. That is equivalent to an annual return of nearly 26%. This investment also has less risk than investing in most stocks; unless energy prices fall substantially this return is quite safe. If this were a stock, most people would jump at the chance to buy it; we should consider the returns on the building investment in the same light.

Payback Period

A basic form of cost-benefit analysis is called "simple payback." In this analysis, the initial costs are divided by the projected annual savings. The result is the number of years required for the investment to pay for itself.

Example: Consider the lighting retrofit of a 10,000 sq. ft. commercial office building. Installing high-efficiency lamps and electronic ballasts will cost $13,000 (266 fixtures at $50 each). Annual savings are projected to be $4,800 per year (80,000 kWh at $0.06/kWh). The simple payback period for this improvement would be $13,000/$4,800 annually= 2.7 years. That is, the improvement would pay for itself in 2.7 years.

Source: Department of Energy Building Technologies Program: Select Cost Analysis Method (2004)

The economic benefits from the 40 California-based projects that Kats studied include gains from reduced energy consumption, emissions reductions, water consumption savings, reduced waste, operations and maintenance cost savings, and improved productivity and health gains.

- **Reduced Energy Consumption**: The buildings studied consumed an average of 28% less purchased energy than conventional buildings. According to Kats, national average energy costs are $1.55/sq. ft. which works out to a 20-year NPV of $5.79/sq. ft.
- **Emissions Reduction**: Recognizing that there is a cost to global climate changes, Kats estimates conservatively the value of buildings' emissions reductions. Assuming costs of $5/ ton of CO_2 (studies have calculated as high as $125) and $1/ton for NO_X, Particulate Matter, and SO_X, the study calculates that the average emissions reduction of 36% for the buildings studied results in a 20-year NPV of $1.18/sq. ft.

- **Water Consumption Savings**: The study found that green buildings typically cut their water consumption by 50% and estimates a 20-year NPV of $0.51/sq. ft. for these savings.
- **Reduced Waste**: Of 21 green buildings studied, 17 reduced construction waste by at least 50%, and eight reduced construction waste by more than 75%. Kats' conservative assumptions produce a 20-year NPV of only $0.03/sq. ft. for the reduced waste, but he estimates that this figure should be closer to $0.50/sq. ft. based on average national waste-related costs.
- **Operations and Maintenance Savings**: Assuming a modest 5% reduction in O&M costs for green buildings, and an average cost of $3,000/person/ year, Kats estimates that green buildings have a 20-year NPV of $8.47/sq. ft. for reduced O&M costs.
- **Productivity and Health Gains**: The value of improved worker productivity and healthier built environments is difficult to calculate, but is perhaps the most significant benefit of green buildings. Kats cites eight studies that calculate the impact on productivity from improved lighting to range from a 3% to 34% gain with a mean of 7%. Additional studies demonstrate a 1%-1.5% productivity gain from healthier indoor environments. Kats' analysis results in a 20-year NPV of $36.89/sq. ft. to $55.33/sq. ft.

Category	20 year NPV/sq. ft.
Reduced Energy Consumption	$5.79
Emissions Reduction	$1.18
Water Consumption Savings	$0.51
Reduced Waste	$0.03
Operations and Maintenance Savings	$8.47
Productivity and Health Gains	$36.89 to $55.33
Cost Premium for Green Buildings (2%)	($4.00)
Total 20 -Year NPV	$48.87 to $67.31

Source: Greg Kats, "The Costs and Benefits of Green Buildings"

Kats' analysis is compelling. Even if one discounts the value of emissions reductions and productivity gains, the savings from energy and water efficiency, construction waste reduction, and reduced O&M costs dwarf the average premiums paid for these LEED-certified buildings and result in significantly positive NPVs. Simply, green buildings save their owners money. By demonstrating the value of green buildings in these terms, developers should be much more able to convince customers of the importance of green and sustainable design.

The Kats study is not the only report on the subject. The full report, as well as several other studies on the economic analysis of green buildings and productivity, is available on the USBGC's website at www.usgbc.org. Click on "Resources" and then "Research."

Net Present Value (NPV)

Payback period is simple to calculate and is convenient to evaluate an investment, but it does not indicate good or bad investments. Net present value (NPV) calculates the relative success of an investment. To calculate NPV, take the initial premium required and add the sum of the present values of all future savings. Present values are future cash flows in current dollars, keeping in mind that a dollar today is worth more than a dollar a year from now. The rate used to calculate present value should represent your other investment options.

Example: Consider the project described in the payback example. Assume the fixtures will last five years and that an alternative investment would return 10%.

Initial premium: -$13,000

PV of savings Yr. 1: $4,800 / 1.1 = $4,364
PV of savings Yr. 2: $4,800 / (1.1)2 = $3,966
PV of savings Yr. 3: $4,800 / (1.1)3 = $3,606
PV of savings Yr. 4: $4,800 / (1.1)4 = $3,278
PV of savings Yr. 5: $4,800 / (1.1)5 = $2,980
Present Value of all savings: $18,196

Net Present Value = $18,196 - $13,000 = $5,196

Investing in efficient lighting is $5,196 better (in today's dollars) than an alternative investment that would return 10% (note: 1.1 is called the "discount factor" and is calculated by adding 1 to the rate of return on your other investments).

Source: Urban Catalyst Associates

The Green Development Spectrum

The technologies and practices that comprise green development represent various levels of effort and impact. Within the Green Development Spectrum on the opposite page, examples of green development are qualitatively ranked by their relative complexity and the degree of commitment typically required to pursue them. Easy to implement practices with little cost and effort are on the left end of the spectrum. At the other end of the spectrum are those practices that require greater financial investment, more commitment, or are just more complex in nature.

Projects on the right side of the spectrum still result in significant returns on investment, but may require a longer investment horizon. Some of these examples may have fewer tangible financial benefits, but clients are often motivated to pursue them by less tangible or more difficult to quantify benefits, such as:

- Positive environmental impacts
- Improved employee moral
- "Doing the right thing"

IHM Motherhouse case study pg 76

This spectrum illustrates many of the actions characterizing the practice of green development, however, it is not a complete list of green development practices. Individual project distinctions, such as the characteristics of a particular site and the size and scope of a project, influence the ordering of actions along the spectrum. Specific cases in this handbook that highlight these actions are referenced.

	Simple Actions Smaller Commitment		Complex Actions Larger Commitment
Site Planning	Cluster development to maximize density 1. Bailey's Grove, p 82	Preserve and relocate trees 1. Bailey's Grove, p 82	Pursue brownfield redevelopment opportunities 1. East Hills Center, p 42 2. DEQ SE Michigan District Office , p 96
Stormwater Management	Design functional landscaping 1. East Hills Center, p 42 2. Forest Hills School, p 62 3. IHM Motherhouse, p 70 4. Bailey's Grove, p 82 5. Malletts Creek Branch Library, p 90	Reduce impervious surfaces, use porous pavements 1. Bailey's Grove, p 82	Install green roofs and stormwater cisterns 1. Helmus Building, p 30 2. East Hills Center, p 42 3. Malletts Creek Branch Library, p 90 4. DEQ SE Michigan District Office , p 96
Energy Consumption	Install energy efficient fixtures and appliances 1. Helmus Building, p 30 2. Forest Hills School, p 62 3. Green Built Demonstration Home, p 76 4. Malletts Creek Branch Library, p 90 5. DEQ SE Michigan District Office , p 96	Buy "green power" or use passive solar design 1. Herman Miller MarketPlace, p 36 2. East Hills Center, p 42 3. Forest Hills School, p 62 4. Zeeland West HS, p 56 5. Malletts Creek Branch Library, p 90 6. DEQ SE Michigan District Office , p 96	Generate renewable energy on-site 1. Zeeland West HS, p 56 2. Forest Hills School, p 62 3. Malletts Creek Branch Library, p 90
Heating and Air Conditioning	Install energy efficient HVAC unit, additional insulation and / or a white roof 1. Helmus Building, pg 30 2. Forest Hills School, p 62 3. Green Built Demonstration Home, p 76 4. DEQ SE Michigan District Office, p 96	Install an Energy Recovery Ventilator 1. Green Built Demonstration Home, p 76	Install a geothermal system 1. Zeeland West HS, p 56 2. IHM Motherhouse, p 70
Materials Use	Use low-VOC paints, carpets, and adhesives 1. Marshall Building, p 50 2. IHM Motherhouse, p 70 3. Green Built Demonstration Home, p 76 4. Malletts Creek Branch Library, p 90 5. DEQ SE Michigan District Office, p 96	Use Insulated Concrete Forms for exterior walls 1. East Hills Center, p 42 2. Green Built Demonstration Home, p 76	Reuse part of existing structure or interior materials 1. Helmus Building, p 30 2. IHM Motherhouse, p 70 3. DEQ SE Michigan District Office, p 96
Construction & Design Processes	Manage demolition waste streams 1. Helmus Building, p 30 2. IHM Motherhouse, p 70 3. Malletts Creek Branch Library, p 90 4. DEQ SE Michigan District Office, p 96	Orient and design building to optimize daylight 1. Herman Miller MarketPlace, p 36 2. Zeeland West HS, p 56 3. Forest Hills School, p 62 4. Malletts Creek Branch Library, p 90	Protect natural areas and create permanent easements 1. Forest Hills School, p 62 2. Green Built Demonstration Home, p 76 3. Bailey's Grove, p 82
Water Consumption	Install low-flow sinks and showers 1. IHM Motherhouse, p 70 2. DEQ SE Michigan District Office, p 96	Install dual flush toilets and waterless urinals 1. Helmus Building, p 30 2. Herman Miller MarketPlace, p 36 3. Green Built Demonstration Home, p 76 4. DEQ SE Michigan District Office, p 96	Install graywater system 1. Forest Hills School, p 62 2. IHM Motherhouse, p 70

The Importance of Integrated Design

Integrated Green Building Design Process

"Integrated design creates cost-effective green buildings. Developing an interdisciplinary team that fully participates in the design and implementation stages encourages us to expand our thinking beyond the immediate design problem and to develop more creative solutions to creating great places to live and work."

Source: Len Pilon, Director of Workplace Strategy, Herman Miller.

Although developers can reap energy savings by taking minor energy efficient improvement measures, the long-term economic benefits of sustainable projects are maximized when developers integrate an upfront whole-building design approach into their projects. Focusing on long-term benefits in the initial stages of planning insures high performance and multiple benefits at lower cost increases.

When professionals practice early-stage integrated design, buildings immediately perform better in the present and the future. Additional benefits from an integrated-design approach include improved operations of the building's systems. The systems are designed early on to work together and significant cost savings are achieved by promoting synergies among artificial lighting, daylighting, and mechanical systems.

Concerns from those inexperienced with green development include perceptions of additional time and expense resulting from these concepts. These issues and more are addressed below.

What is Integrated Design?

In integrated design, multi-disciplinary teams of building professionals work together from the pre-design phase through post-occupancy to optimize a building's environmental sustainability, performance, and cost savings. This design approach recognizes that a successful green building is best achieved by planning the site, structure, components, and systems as interdependent parts of a whole system, and optimizes their interaction for economic and environmental benefits.

One example of integrated design is the installation of a white roof such as in the Forest Hills case on page 62. A white roof may cost substantially more than a black roof and on that basis, a traditional building design might discount it. However, if you consider the impact a black roof has on cooling demand during the summer months - it requires a much larger heating and cooling system to handle the load - this is where integrated design comes in. Under this viewpoint, the cost of the white roof is offset by a savings from installing a smaller HVAC system and lower ongoing energy costs. Many times the true cost of a white roof is less than a conventional black roof taking into account just one year of energy savings, and it continues to provide savings over the life of the building.

Although not covered in detail in this handbook, another example of integrated design is the Ford Rouge plant in Dearborn, MI. By installing a green roof on the plant, storm water runoff was reduced so significantly that the plant did not need to install several expensive storm water retention basins. Not only did this reduce capital costs, it also meant that Ford did not have to use more of its valuable land for the basins, and will not have to maintain them going forward.

The key to success in integrated design is to think of these different disciplines as a cohesive structure. By starting early and involving the essential components of a first-rate "design team" – developers, architects, engineers, clients/potential tenants – mistakes and miscommunications diminish and opportunities to maximize savings increase. By working together throughout the design process, team members identify highly attractive solutions to design needs that might not otherwise be found.

How do I create the right team?

A design team shapes the function, comfort, appearance, and performance of any building. Owners, developers, architects, major sub-contractors, occupants, and commissioning agents come together early in the project. This essential collaboration reduces waste and allows systems normally designed independently from each other to operate optimally.

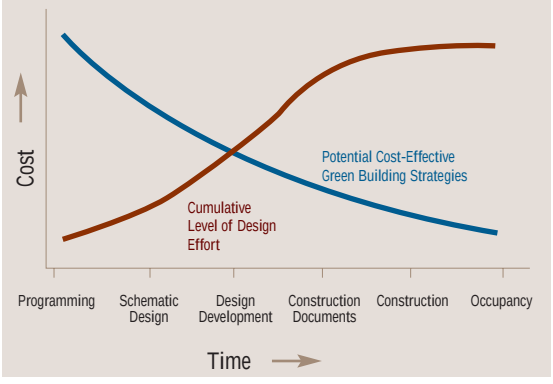
When assembling your team, select team members committed to meeting the project's goals. Team members do not each need to be experts in the field of green design, but must fundamentally understand the benefits of green buildings, agree with the project goals, and have a strong desire to work with sustainable design and green buildings.

The size of the team and the aggressiveness of the design goals determine who should be on the team. The team members must communicate effectively with one another on all design decisions. Communication is critical because when a decision affects the performance of another team member's area, the team will be better able to evaluate the consequences up front and make modifications to the design in the early stages. A useful tool for establishing communication between team members and developing goals is a design charrette.

Does Integrated Design cost more to implement?

Early integration of design and engineering planning reduces costs. Integrated design projects keep within the original budget because they eliminate redundancies built into standard structures, thereby decreasing both hard costs (i.e. construction costs) and soft costs (i.e. architectural and engineering fees).

In addition, by emphasizing the up-front integration and planning stages, project proposals are planned ahead of time and initial cost savings are realized - a major advantage when working with city planning and development review processes. Also, identifying potential obstacles early in the process diminishes the possibilities of costly errors and design mistakes. The Integrated Green Building Design Process Graph on graph below represents the costs of integrated design efforts at various stages of time.



Source: Green Building and the Integrated Design Process, Alan Scott, AIA (www.greenbuildingservices.com)

How do I find local architects, engineers, and financing sources with experience in green building and energy efficiency?

Several resources identify potential members of integrated design teams. Keep in mind, however, you may already work with people who are familiar with green design or who are interested in learning more. To build a team, start by contacting people who have pursued green and sustainable projects, such as those in this handbook's case studies. Several of these individuals are experts themselves and have extensive Michigan-based networks with whom they work. Another resource is the DEQ (www.michigan.gov/deq), which can point you towards many more green projects around the state.

The USGBC also has a list of accredited professionals who have taken an exam and have demonstrated familiarity and some expertise with green building issues and process. To find this list, go to www.usgbc.org, open the "LEED" link and then click on "Accredited Professionals". In addition, organizations such as The American Institute of Architects (AIA) provide online directories of their members and can identify knowledgeable green building professionals. Visit the AIA website (www.aia.org), select "find an architect" and "advanced search." Input a project category, state, and city, and under "types of services," select "sustainable design."

"When project design and construction professionals have completed a few LEED-certified projects they become familiar with the intent of the process and the certification requirements, allowing them to prepare materials more efficiently. With each LEED project completed, we have found the design and LEED- documentation time is significantly reduced."

- Steve Hamstra, Zeeland West High School, pg 56

The Market for Green Buildings

The market for green or sustainable buildings has experienced significant demand increases over the past several years. In just five short years, USGBC LEED-certified buildings have captured nearly 3% of the entire new building market in the United States, and the number of projects registering for certification continues to grow: over 670 new LEED registrations occurred in 2004 (See Figure 1). Jerry Yudelson, author of The Insider's Guide to Marketing Green Buildings and USGBC board member, believes that this growth rate will continue far into the future.

The market for these buildings is broad and deep. Educational buildings and commercial offices represent 1/3 of all LEED buildings, and green buildings are popping up in all building categories (see Figure 3). Buildings registered for LEED certification are located in all 50 states, clearly demonstrating the extensive reach of the market. As the market begins to better understand green and sustainable buildings, as well as the far-reaching benefits of these buildings, demand will continue to grow. Additional information about LEED and the USGBC is located on pg 24.

The Market in Michigan

With nine LEED-certified projects, Michigan ranks 6th in the US behind California (34), Washington (20), Pennsylvania (16), Oregon (14), and Georgia (10) - (see Figure 2). In addition to the nine projects already LEED certified in Michigan, 59 additional projects have registered for certification (see Figure 3 for a categorical breakdown of all LEED-certified and registered buildings in Michigan).

Source: USGBC LEED registered and certified projects.

> *"I'm not sure that anyone could have predicted the rapid expansion of the market for high performance, sustainable green buildings, but the demand is undeniable. . . . Everything has changed."*
>
> - Pamela Lippe, Executive Director of Earth Day New York (preface to "The Costs and Benefits of High Performance Buildings")

LEED-Registered Projects in the US

Project Type	Registered Projects	Percent of Total
Commercial Office	470	18%
Education (K-12 & Higher)	429	16%
Multi-Unit Residential (apartment, dormitories)	148	6%
Laboratory	147	5%
Assembly (conv. center, place of worship, theater)	143	5%
Interpretive Center (museum, visitor center, zoo)	142	5%
Library	121	5%
Industrial (manufacturing, warehouse, pub. works)	118	4%
Campus (corporate campus school)	116	4%
Retail (store, supermarket, art gallery)	113	4%

source: www.usgbc.org/leed/project/stats

Figure 2

LEED-Certified Projects in Michigan

Project	City	LEED Rating	Case page number
The Herman Miller MarketPlace Building	Zeeland	Gold	Page 36
Ice Mountain Bottling Plant	Stanwood	Certified	
Herman Miller C1 Main Site	Zeeland	Gold	
Forest Hills School	Grand Rapids	Certified	Page 62
Ford Rouge Visitor Center	Dearborn	Gold	
Herman Miller BG Main Site	Zeeland	Certified	
Steelcase Wood Furniture Manufacturing Plant	Caledonia	TBD	
Detroit Lions HQ & Training Facility	Allen Park	Certified	
Helmus Building	Grand Rapids	Silver	Page 30

Source: USGBC LEED registered and certified project.

Figure 3

LEED-Registered and Certified Projects in Michigan

Project Type	Count
Commercial Office	29
K-12 Education	8
Higher Education	5
Industrial	4
Retail	3
Multi-unit Residential	3
Public Order & Safety	2
Laboratory	2
Interpretive Center	2
Healthcare	2
Assembly	2
Stadium	1
Library	1
Daycare	1
Other	3
Total	68

Source: USGBC LEED registered and certified projects.

"According to the U.S. Green Building Council, Michigan currently ranks 8th in the nation for the number of energy-efficient, environmentally friendly building projects currently on the drawing board. If this trend continues, Michigan could become a model state for green building activity."

- Carolyn Kelly, Great Lakes Bulletin News Service, "Green Goals 'LEED' To Calls to Enhance Building Rating System,"

State Level Initiatives

Promoting strong growth of green buildings, Michigan's DEQ emphasizes specific aspects of green development, such as green infrastructure and innovative stormwater design, to encourage communities to include these aspects in their urban redevelopment plans. The DEQ promotes green development through education and technical and financial assistance. More information about DEQ activities can be found at www.michigan.gov/deq

In addition, in April 2005, Governor Jennifer Granholm announced Executive Directive No. 2005-4 which directs the Department of Management and Budget (DMB) to reduce energy use in all state-owned and operated buildings 10 percent by December 31, 2008, and to reduce grid-based state energy purchases 20 percent by 2015. The Governor's directive requires immediate adoption of an array of energy conservation improvements in lighting, heating, ventilation and air conditioning, as well as mechanical improvements to cut energy costs.

Among building initiatives, the directive requires that all new buildings for state agencies, universities, and community colleges be LEED (Leadership in Energy and Environmental Design) certified. This effort is designed to ensure that all new state facilities are energy efficient in operation and maintenance and are designed to have minimal impact on the environment. The Governor's executive directive also creates an annual Governor's Energy Efficiency Award program to recognize energy efficiency efforts by state agencies.

Michigan-Specific Green Organizations

The following Michigan-based organizations support sustainable development initiatives and can help you expand your network.

- Center for Sustainable Systems, University of Michigan http://css.snre.umich.edu/
- Detroit Green Map www.detroitgreenmap.org www.detroitgreenmap.org/resources.pdf (Michigan green building suppliers/resources)
- Environmental House Green Building Resource Center - Ann Arbor www.environmentalhouse.org
- Home and Building Association of Greater Grand Rapids - Green Built Certification www.hbaggr.com/about_issues_green.htm
- Interstate Renewable Energy Council www.irecusa.org/index.html
- Michigan Department of Environmental Quality www.michigan.gov/deq
- Michigan Department of Labor and Economic Growth - Energy Office www.michigan.gov/cis/0,1607,7-154-25676---,00.html
- Michigan Interfaith Power & Light Partners Program www.miipl.org/index.html
- o2 Michigan www.o2-usa.org/mi
- University of Detroit Mercy - School of Architecture www.arch.udmercy.edu
- University of Michigan School of Natural Resources and Environment www.snre.umich.edu
- USGBC Detroit Chapter www.usgbc.org/Chapters/Detroit
- USGBC West Michigan Chapter www.usgbc.org/chapters/westmichigan

Segmenting the Market for Green Buildings

Sustainable buildings provide benefits that matter to all clients. The table below outlines three theoretical categories of clients ranging from those seeking to reduce costs to "green leaders" looking to create marquee buildings that demonstrate their commitment to the environment and society. Within each category, the table breaks down (1) the key drivers that shape clients' decisions about a project, (2) an example of how you might position a green or sustainable building concept to clients, (3) examples of benefits that resonate with clients, and (4) common concerns and misperceptions to expect from these clients. This segmentation of client types is designed to correspond to The Green Development Spectrum on page 17 of this book.

Often clients view benefits differently. For example, one person interested in reducing costs will respond well to the idea of downsizing an HVAC unit as a result of improved efficiency and insulation. In this case, focus your message on the cost savings; efficiency is a means to save money. Another client, on the right side of the spectrum, may value efficiency in itself. The client may be interested in saving money on the project, but will be motivated primarily by the conservation of resources.

	Cost Reduction Seekers		Green Leaders
Key Decision Drivers	• Construction costs • Operating costs • Potential future liabilities • Functional building improvements	• Energy efficiency • Political correctness or Public Relation benefits • Waste minimization	• Making a statement with a marquee building • Being a green innovator • Demonstrating commitment to sustainability
Possible Positioning	• "Sustainable design saves you money."	• "Sustainable design saves money and helps protect the environment."	• "A green or sustainable building is an opportunity to demonstrate what you believe."
Supporting Benefits	• Capital costs savings (construction phase) • Lower operating costs • Healthier and safer working environments	• High energy-efficient building process equals less waste • Building's efficiency saves resources throughout its life	• Work environment boosts employee productivity, supports local economy, and protects the environment
Concerns & Misperceptions	• Do not want to be viewed as "environmentalists" • Believes that "green buildings" cost more	• Cost concerns exist • Skeptical about green technologies	• Needs committed developer and contractor • The market may not yet exist

Source: Urban Catalyst Associates

"The key is to find a person's 'hot buttons' for pursuing green development. Whether their reason for doing so is environmental benefits, chemical sensitivity, or energy efficiency, focusing on that purpose will make the project more easily justifiable."

- Lynn Rogien, Everett Marshall Building Case, page 50

The USGBC and LEED

What is the USGBC?

The United States Green Building Council (USGBC) is a coalition of leaders across the building industry whose primary goal is to promote buildings that are environmentally responsible, profitable, and provide healthy surroundings for occupants. USGBC-member organizations range from product manufacturers and architects to federal, state, and local government agencies.

What is LEED?

The USGBC created and maintains the LEED (Leadership in Energy and Environmental Design) Green Building Rating System, the emerging national standard for high-performance, sustainable buildings. The USGBC has developed LEED criteria for the following categories:

1. New commercial construction and major renovation projects (LEED-NC)
2. Existing building operations (LEED-EB)
3. Commercial interiors projects (LEED-CI)
4. Core and shell projects (LEED-CS)
5. Homes (LEED-H)
6. Neighborhood Development (LEED-ND)

For each category there is a checklist of available points that a specific project can earn to receive one of four levels of certification: Certified, Silver, Gold, and Platinum. To be considered for certification, a project must first register with the USGBC.

Who is pursuing LEED certification?

As of the writing of this handbook, over 1,600 projects were registered for LEED. Registered projects cover a wide range of building types led by commercial offices (18%) and educational facilities (16%). Not only are small companies and organizations building LEED-certified projects, corporations and other large entities are also involved, which means they are regularly answering to and convincing shareholders and other stakeholders of the benefits of pursuing LEED certifications. The following is a sample of some of the organizations pursuing LEED:

Universities and Colleges Pursuing LEED

- Brown University
- Dartmouth College
- Harvard University
- Northern Michigan University
- Northwestern University
- Ohio State University
- Penn State
- UC Berkeley

Corporations Pursuing LEED

- Bank of America
- Ford
- Goldman Sachs
- Johnson & Johnson
- JPMorganChase
- Pfizer
- Raytheon
- Toyota

Shortcomings of LEED:

LEED is not the only certification standard available for sustainable buildings, but it is the most common and covers the widest range of building types. However, LEED is not perfect; two major criticisms of LEED are (1) it focuses primarily on the structure/site and does not do enough to encourage "smart growth," and (2) the point system drives people to focus on getting points for the sake of getting points instead of underscoring the importance of the underlying objectives.

"Don't just think about LEED standards for LEED projects. The principles behind LEED should be incorporated whether certification is pursued or not."

- Steve Hamstra Zeeland West High School, pg 56

The Bottom Line: Why Green Development

The 1987 World Commission on the Environment and Development defined sustainable development (in a broader context than real estate development) as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." Traditional building practices often do not stand up to this ideal, necessitating inefficient energy use, using non-recyclable construction materials, and over-consuming land, timber, plastics, and chemicals. Green development projects, on the other hand, respect future generations and provide today's developers and building users with the satisfaction of "doing the right thing" by owning the financial, environmental, and social responsibilities of beneficial development.

Driven by external market pressures and associated prices, green building is fast becoming the industry standard, and with energy and petroleum costs rising, the demand for energy-efficient technology will continue to increase. State and federal regulations demand that industries become increasingly leaner and more energy efficient, and that future policies and incentives reward those who incorporate energy efficiency into their projects. Clearly, this is the case in the residential and commercial building industries as grants, tax incentives, and government support are increasingly allocated to more energy efficient and sustainable projects. As noted, Michigan leads the way, as other states are quickly catching on to the possibilities of sustainable and green building development.

Undertaking green development projects demonstrates a commitment to quality, permanence, and stewardship that improves an owner's or a developer's reputation in the community and in the industry as a whole. Those involved with sustainability are viewed as innovators, exemplars, and leaders in their fields and good people to do business with in the future. In his Site Planning and Design Handbook, Thomas Russ writes that "buildings once reflected an elegance of design, a thoughtful construction based on awareness of the environment. Buildings in this tradition were active working machines." Green development is "active" building that reminds us of our connection to a world larger than ourselves, a world to be inherited by our children. Our responsibility today is to create and maintain sound environmental, social, and fiscal legacies. The practice of sustainable, green development is the crucial pillar of that responsibility.

REFERENCES:

"Everyone Benefits from Green Building." Boston Mayor Menino's Green Building Task Force Report, Fall 2004.

http://www.usgbc.org/LEED/Project/project_list.asp?CMSPageID=247&

Kats, Gregory. *The Costs and Benefits of Green Buildings*. Massachusetts: Massachusetts Technology Collaborative, 2003.

"Productivity and Green Buildings." *Environmental Building News*, www.buildinggreen.com, October 2004

Russ, Thomas. *Site Planning and Design Handbook*. New York: McGraw-Hill, 2002.

The USGBC. "Certified Project List" and "Registered Project Search." *LEED*. The US Green Building Council 15 Mar. 2005. US Department of Energy website www.doe.gov

World Commission on Environment and Development (The Brundtland Commission), 1987, Our Common Future, Oxford: Oxford University Press.

Yudelson, Jerry. (2004). *The Insider's Guide to Marketing Green Buildings*. Portland, OR: Green Building Marketing, 2004.

Case Study Matrix

		COMMERCIAL			EDUCATIONAL			RESIDENTIAL			INSTITUTIONAL	
		Helmus Building *Grand Rapids*	Herman Miller MarketPlace *Zeeland*	East Hills Center *Grand Rapids*	Everett Marshall Building *Ypsilanti*	Zeeland West High School *Zeeland*	Forest Hills High School *Ada*	Green Built Demonstration Home *Grand Rapids*	IHM Motherhouse *Monroe*	Bailey's Grove *Kentwood*	Malletts Creek Branch Library *Ann Arbor*	DEQ Southeast Michigan District Office *Warren*
	Page Number	30	36	42	50	56	62	76	70	82	90	96
Key Topics	Brownfield Redevelopment			●								●
	Stormwater Management			●		●				●	●	●
	Materials Use	●	●	●	●		●	●	●		●	●
	Energy Efficiency	●	●		●	●	●	●	●		●	●
	Water Efficiency						●	●	●	●		●
	Social Benefits	●	●	●	●		●		●	●	●	
	Development Processes		●				●	●	●	●	●	●
	Cost-Benefit Analysis		●				●	●				
	Funding Sources			●	●	●					●	
Benefits of Green Development	Reduced Capital Costs	●	●			●	●			●		●
	Lower Operating Costs	●	●	●		●	●	●	●		●	●
	Reduced Risks & Liabilities		●	●				●		●		
	Less Environmental Impact	●	●	●	●	●	●	●	●	●	●	●
	Healthier Indoor Environment and Improved Productivity	●	●		●		●	●	●		●	●
	Stronger Social Networks	●		●	●		●		●	●	●	
	Increased Environmental Awareness		●		●	●	●		●	●	●	●
Costs	Under $1 million			●				●				
	$1 million - $10 million	●									●	
	$10 million - $50 million				●	●	●					
	Over $50 million		●						●	●		



ENTER
THE
NIVER




commercial

This grand entrance to Bazzani's offices was achieved by removing the former mezzanine, opening the space to create the current entrance.

Project type	Commercial
Project scale	Building
Construction type	Renovation - Urban
Date completed	July 2002
Address	959 Wealthy SE, Grand Rapids MI 49506
Subjects	Energy Efficiency
	Materials Use
	Social Benefits
	Lessons Learned
Total project costs	$1,042,800 (soft costs) $249,000 (building acquisition)
Building	9,480 sq. ft.
Cost	$110 / sq. ft. (soft costs, excluding building acquisition)

Grand Rapids, Michigan

Helmus Building

History

Built in 1918, the Helmus Building in Grand Rapids, Michigan, was a dry storage warehouse for most of its life. After going vacant and falling into a state of disrepair, much like the surrounding neighborhood, Guy Bazzani purchased the building in 1999. Bazzani bought the Helmus Building not only for its redevelopment potential, but because of his commitment to the local community.

For over a decade, Bazzani has been active in real estate development in the area, and sustainable building design and development are at the core of his business practices. Intending to locate his offices in the Helmus Building, he sought to demonstrate the economic, social, and environmental value of sustainable design with this project; the Helmus renovation project is an historic rehabilitation that salvaged 100% of the original shell, and more than 50% of the non-shell materials. The super-insulated and super-efficient building pays dividends in many ways: utility and water bills are significantly lower than comparables, and the improved insulation of the building envelope have enabled Bazzani to downsize the HVAC systems, reducing construction costs as well as future replacement costs.

The Helmus Building is more than just energy and water efficient. Under its one roof, the building mixes residential, commercial, and retail uses. Sustainable materials – including low-VOC paints, recycled carpeting, and recycled content ceiling pads – were used throughout the renovation. Most important, this project affected more than Bazzani Associates and its customers; the renovation of the Helmus Building sparked the revitalization of the surrounding community.

VOC - *Volatile organic compounds; Secondary petrochemicals which evaporate readily into the atmosphere at normal temperatures. They include light alcohols, acetone, trichloroethylene, perchloroethylene, dichloroethylene, benzene, vinyl chloride, tolulene, and methyl chloride. These potentially toxic chemicals are used as solvents, degreasers, paint thinners, adhesives, and fuels and contribute significantly to photochemical smog production and certain health problems. Signs and symptoms of VOC exposure may include eye and upper respiratory irritation, nasal congestion, headache, and dizziness.*

Energy Efficiency

Initially, the exterior walls of the Helmus Building consisted of only brick. Upon renovation, all exterior walls were super-insulated using the Icynene Insulation System, an open-cell foam insulation with an R21 rating. Additionally, the energy efficiency of the walls was increased through the use of thermal breaks, vapor barriers, and low-E glass in all the windows. The building was built to ASHRAE / IESNA 90.1-1999 energy efficiency standards, and Bazzani estimates that his super-insulated building saves him roughly $2,444 annually in gas and electric utility costs.

Energy Efficiency

1st floor offices = 4,740 sq. ft.

Annual natural gas = $1,229

Annual electricity = $1,987

Total of $0.68/sq. ft./yr

In addition to super-insulating the walls, several energy efficient devices were installed throughout the building, including dimmable compact fluorescent lights, timers for all light fixtures, and occupancy sensors. ENERGY STAR-rated appliances and equipment also were installed throughout the building. One of the most innovative approaches to conserving energy was the design of the building's awnings, positioned at an angle to shade the storefront windows in the summer and to allow maximum sunlight penetration in the winter to optimize passive solar gain.

To complete the energy-efficient envelope of the building, Bazzani installed a Carlisle-Syntec 2,511-square-foot green roof. Using plants that require little water and maintenance, the green roof helps release moisture, cool the building in the summer, and reduce stormwater runoff, in addition to conserving energy and prolonging the life of the roof. Additionally, the green roof was designed as a usable rooftop garden providing additional green space for occupants of the building to enjoy.

Bazzani's investments in efficiency created immediate and long-term savings. The improved insulation of the building allowed them to downsize HVAC equipment, reducing construction costs. According to Nathan Gillette, Project Manager for Bazzani Associates, "We almost couldn't find HVAC equipment small enough for the building and ended up using a residential unit." They selected a Bryant 350MAV Furnace and a Bryant 533A central air conditioner. The downsized HVAC equipment coupled with the building's energy efficient envelope offer significantly reduced annual energy costs at $0.68 per square foot per year.

In addition to cooling the building in the summer, reducing water runoff, improving energy efficiency, and prolonging the life of the roof, this green roof creates new usable space for occupants.

thermal breaks - *An insulating barrier which provides a separation between construction elements that are exposed to the outside. A thermal break minimizes the possibility of condensation on surfaces of exterior framing.*

vapor barriers - *An impermeable membrane that blocks the flow of air through the building envelope. Vapor barriers protect the building envelope structure and insulation from condensation damage, prevent air leakage, and maintain interior humidification.*

Bazzani's emphasis on sustainability and environmentally friendly materials results in very comfortable and attractive residential space.

The Helmus Building offers its tenants nicely appointed workspace with ample daylight.

Materials Use

Reuse is always the optimal choice for any material that reaches the end of its intended life, and Bazzani Associates wholeheartedly embraced the reuse concept when renovating Helmus. In fact, Bazzani reused 100% of the building's existing frame and more than 50% of the "non-shell." One of the most unique reuses was the loading dock, which originally was two feet higher than the rest of the first floor to accommodate delivery trucks. Rather than sending all the concrete from the loading dock to a landfill, Bazzani disconnected it from the walls and lowered it to ground level, providing a perfectly surfaced floor for what is now the building's new garage.

Finishing materials were selected to maximize sustainability. Interface carpeting with recycled nylon and backing material was used on the floors throughout the Helmus Building as were Armstrong Cirrus ceiling tiles containing 72% recycled content. All paints, stains, and sealants were low-VOC products. As a result of the carefully developed and implemented waste management plan, the renovation project generated less than 25% of the waste normally generated by new construction of a similar building.

low-E glass - *Low-emissivity windows: glazing that has special coatings to permit most of the sun's light radiation to enter the building, but prevents heat radiation from passing through.*

ASHRAE - *American Society of Heating, Refrigerating, and Air-conditioning Engineers*

Social Benefits

Incorporating multiple uses into one facility ensures that the capital and energy invested in the project are used to a higher potential while delivering social benefits, such as reducing transportation demands and creating a more vibrant community. Bazzani Associates' core staff of five and Clean Water Action, a local non-profit, inhabit the office space on the first floor of the Helmus Building. Guy Bazzani and his wife reside on the second floor, where two additional residential units are nearing completion. Finally, local individuals and businesses rent storage units in the basement.

Guy Bazzani has a proven track record of personal involvement in the community, including his work with local non-profits and his involvement with the West Michigan Sustainable Business Forum and EDGE2 advisory committee (Economic Development and Growth through Environmental Efficiency). The Bazzani's Helmus Building project has extraordinarily impacted the surrounding community. When Bazzani bought the building in 1999, the neighborhood was plagued with drugs and prostitution. In fact, the police often used the Helmus Building for stakeouts.

After years of decay, Bazzani's redevelopment catalyzed the revitalization of the surrounding area. As a result of the renovation, the city invested in new street lighting, paved the main street with recycled bricks, and implemented a program to curb graffiti that has plagued the area. Just after the completion of the building, several new and local businesses moved into the neighborhood.

Lessons Learned

According to Guy Bazzani, the historic preservation and renovation of the Helmus Building in Grand Rapids went fairly smoothly, although the project hit a snag when Bazzani wanted the state's Historic Commission to approve new low-E glass windows for the building. The Commission originally rejected the permit request because of the building's "historic" designation and the Historic Commission's concern that the low-E glass would not match the reflective properties of other historic windows in the area. After several presentations to the Commission, Bazzani's request for the new windows was approved.

Awards

- LEED-NC Silver
- Best Exterior Renovation, Grand Rapids Historic Preservation Commission
- Outstanding Commercial Historic Preservation, City of Grand Rapids
- NBA Award (Neighborhood Business Alliance) for Best Façade
- Certificate of Excellence for Best Reuse of a Building
- 2003 Outstanding Historic Preservation Project Award
- 2003 Outstanding Historic Preservation Volunteer Award

"We almost couldn't find HVAC equipment small enough for the building and ended up using a residential heating unit."

- Nathan Gillette

The Bottom Line

The Helmus Building illustrates what can be accomplished despite the limitations of a renovation project and a historic rehab. Bazzani's investments in energy efficiency resulted in reduced capital requirements (downsizing HVAC equipment, for example) and will pay future dividends through reduced utility bills. Furthermore, his pursuit of a mixed-use structure insures that his investments will be fully utilized while also delivering social benefits to society and the building's occupants.

Located inside Bazzani's apartment, this spiral staircase provides access to the green roof to barbecue, take in summer rays, or just enjoy the view.

References

Interviews with Nathan Gillette and Rachel Lee
The Helmus Building, Bazzani Associates
The Helmus Building Story, Bazzani Associates

Contact Information

Builder and Developer	Bazzani Associates, www.bazzani.com
Nathan Gillette	AIA, LEED-AP, CNU, Project Design Manager, Bazzani Associates, (616) 774-2002, nate@bazzani.com
Rachel Lee	Neighborhood Development Liaison, Bazzani Associates, (616) 774-2002, rachel@bazzani.com
Architect of Record	DTS Architects, 62 Commerce St. SW Suite 200,G.R., MI, 49503 (616) 451-4707 Contact: Dave Sobota

Resources for further information

Icynene Insulation System - www.icynene.com
Armstrong Ceiling Tiles - www.armstrong.com
Bryant HVAC Systems - www.bryant.com
Interface Flooring Systems - www.interfaceflooring.com
Carlisle-Syntec Rooftop Planting Systems - www.carlisle-syntec.com

The MarketPlace is one of the only LEED Gold buildings in Michigan and has won numerous awards for its innovative design.

Project type	Commercial
Project scale	Building
Construction type	New Construction - Greenfield
Date completed	January 2002
Address	855 East Main Ave., Zeeland, MI
Subjects	Development Processes
	Energy Efficiency
	Social Benefits
	Lessons Learned
	Cost Benefit Analysis
Total project costs	$8,455,000 (land excluded)
Building square footage	95,000 sq. ft.
Cost / square foot	$89 / sq. ft.

Zeeland, MI

Herman Miller MarketPlace

History

The MarketPlace grew from the need to reduce the size of functional areas and to move employees into one building. Before working together in the MarketPlace, employees worked in four different buildings, each with its own lease. Rather than renew each lease, Herman Miller decided to condense resources and construct one high-performing, centrally located building to house those employees.

Herman Miller collaborated with The Granger Group of Companies, a Michigan-based development company with head offices in Lansing and Grand Rapids, to design and develop the building. The two companies formed a unique partnership, both believing in the economic, social, and environmental benefits of building an energy-efficient, LEED-certified building. As both the developer and owner of the building, Granger understood that a unique and energy-efficient property could easily be marketed as a healthier and more productive workplace.

If Herman Miller vacated the lease, Granger felt that it would be easier to lease a high-performing building compared to a traditionally built office building. The Granger Group offered to build at LEED Silver standards. The subsequent lease agreement mandated that a LEED-rated project tie the cost of the base rent directly into achieving that rating. Although the initial goal was to achieve the LEED Silver rating, the building earned the more coveted Gold rating.

"Marketplace is a prime example of how Herman Miller continues to take a leadership role in bringing the environmental sustainability ethic to the corporate workplace."

-Len Pilon, HM director of Workplace Strategy and Facilities.

Development Processes

The Granger Group is committed to green building because, not only is it environmentally sound, it makes the most economic sense in both the short and long terms. By building green and marketing its skill and expertise developing these types of buildings, Granger differentiates itself from its competition. Furthermore, as green building costs have begun to equalize with traditional building costs and as market demand pushes costs lower, the return on investment (ROI) time period is decreasing. According to Greg Markvluwer, developer at the Granger Group, Granger has earned a two-to-five-year payback on all the initial fixed costs on of their green design projects. "Even if you don't go for LEED certification, consider all the benefits of green building design. The principles of green building, whether part of a LEED-certification process or independently undertaken, make good economic sense for all parties involved," said Greg Markvluwer.

For Granger, integrated design was an essential component of this project. As the project was conceptualized, Granger offered Herman Miller a flexible, LEED-influenced building outline that supported Herman Miller's goals. The design process involved not only Granger and Herman Miller, but included the architecture and design team. Working cooperatively in these functional areas made reaching the goals of energy efficiency and LEED certification much easier.

Prior to the completion of the MarketPlace, Herman Miller employees worked in four separate buildings. By condensing employees and resources into one energy-efficient building, Herman Miller saved on rental and energy expenses.

"This project is sure to draw attention from around the country. MarketPlace is an outstanding demonstration of businesses simultaneously achieving strong economic and environmental performance through smart building design."

-Christine Ervin, US Green Building Council President and CEO

The materials used within the MarketPlace provide for optimal exterior daylight to penetrate into the interior. Specific acoustical absorbent materials help to lower reflected noise levels.

Energy Efficiency

MarketPlace achieves significant energy savings by using standard HVAC products available from multiple manufacturers. The HVAC system's installed cost is less than $14 per square foot and realizes a 40% reduction in energy use over ASHRAE standard 90.1. The building automation system–including highly efficient rooftop units, variable air volume energy-recovery units, and perimeter radiant heating–allows users to control systems.

Abundant daylighting decreases the energy needed for indoor lighting, with glass accounting for more than 62% of the building's exterior walls. Carefully selected light sources maintain an average of 0.9 watts per square foot and minimize lighting-system energy demands. The lighting strategy provides adequate general light in coordination with passive daylighting. Task lighting at the work surface is used only when needed.

Social Benefits

By condensing resources and moving employees from four separate buildings into the one, more collaborative MarketPlace building, employee productivity and overall satisfaction at the company increased.

Organizational Effectiveness	Worker Effectiveness
Job Satisfaction	Privacy
Culture and Corporate Image	Comfort
Collaboration	Personalization
Work Group Process Quality	Lighting
Communication	Workspace Layout
	Control over Environment

These findings illustrate the link between workplace design features, changes in key employee behaviors, and measurable outcomes related to greater efficiencies in the workplace environment. The health and social benefits easily transfer to the residential environment.

Employee Effectiveness Measures

17% increase in satisfaction with quality of lighting

13% increase in perceived availability of alternative settings to do individual work

20% decrease in personal travel distance

7% increase in worker productivity following the move to a green, day lit facility

Source: Herman Miller

ASHRAE - *American Society of Heating, Refrigeration, and Air-conditioning Engineers*

Lessons Learned

Herman Miller realizes that sustainable design must begin early in the design process, not as an add-on at the end of a project. Developers need to set roles and expectations at the beginning of the project as LEED points can be lost by simple mistakes. For example, the project lost a LEED point because an HVAC filter was installed backwards. The intent was there, but the execution of this particular point was not.

This project achieved its LEED Gold rating because the corporate client is committed to the environment. Mike Volkema, chairman and CEO of Herman Miller, Inc., says that in regard to the company's commitment to the environment, "We strive to contribute to a world of ecological balance and economic abundance. We build sustainability into all aspects of our business." This dedication to sustainable business practices allowed the Herman Miller project to receive its well-earned Gold rating.

Cost Benefit Analysis

The total amount saved in operational costs over a seven-year lease has been calculated at $1,001,000. The following value metrics of the project indicate the savings over a traditional 100,000 square-foot building with a seven-year lease:

- Building costs, including tenant improvements: 33%
- FF&E (Furniture, Fixtures & Equipment): 11%
- Operations costs for 5 months of occupancy: 41%
- Churn costs: (IFMA baseline: 44% churn at $748 per move): 66%

	Traditional Leased	Marketplace	Savings
Building Costs (including TI)	$135 / sq. ft.	$89 / sq. ft.	$4,600,000
FF&E Costs	$31 / sq. ft.	$27.58 / sq. ft.	$341,920
Utility Costs	$1.97 / sq. ft.	$1.17 / sq. ft.	$0.80 / sq. ft. ($560,000 / 7years)
Churn Costs	$1.58 / sq. ft.	$0.55 / sq. ft.	$1.04 / sq. ft. ($726,017 / 7 years)

Source: Herman Miller

Awards

- Finalist for Business Week / Architectural Record "Good Design is Good Business 2003"
- State of Michigan AIA Award for Sustainable Design, 2004
- Environmental Design and Construction, Excellence in Environmental Design Runner Up Award 2003
- Sustainable Buildings Industry Council (SBIC) Exemplary Sustainable Business Award

References

PowerPoint presentation supplied by Len Pilon of Herman Miller

Case Study developed by USGBC, www.leedcasestudies.usgbc.org/overview.cfm?projectID=189

Case Study developed by US DOE, www.eere.energy.gov/buildings/highperformance/case_studies/overview.cfm?ProjectID=189

"Herman Miller MarketPlace exhibits unusual interior flexibility while providing a significantly high level of amenity and indoor environmental quality including water and light, and the ability of the site to detain a 100-year storm event. This is a promising prototype for an economically viable, environmentally sensitive, and sustainable solution in the speculative office market."

-Jury naming the MarketPlace a top 10 project in the world, AIA Committee on the Environment.

The Bottom Line

Herman Miller discovered that no matter how committed a company is to green design, sustainability cannot be accomplished without the assistance and guidance of others. Successful sustainable design depends on the commitment of all the members of the team, including the architect, client, and contractor.

By incorporating integrated design from the beginning, the developer, client, and design team realized even greater long-term savings and benefits than initially projected. MarketPlace is Michigan's first developer-owned LEED project, and joins less than fifty Gold-certified projects nationwide. This distinction places MarketPlace among the country's best buildings defined by environmental responsibility, construction, and operating costs, and as a healthy place to live and work.

The entire design team worked to create an effective building without losing track of the initial cost. The target was an HVAC system that requires 40% lower energy costs than what is budgeted in the baseline model ASHRAE 90.1 - 1999.

Contact Information

Client	Paul Murray, Herman Miller, paul_murray@hermanmiller.com
Developer	Greg Markvluwer, The Granger Group, gmarkvluwer@thegrangergroup.com
Architect	Mike Corby, AIA, Integrated Architecture www.intarch.com

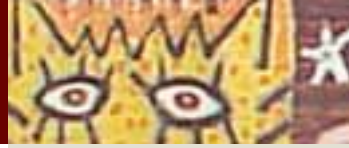
Resources for further information

www.hermanmiller.com

www.usgbc.com

www.thegrangergroup.com

Once an abandoned brownfield site, the East Hills Center now serves as a focal point for the community.



Project type	Commercial
Project scale	Building
Construction type	New Construction - Urban Infill
Date completed	October 2004
Address	1001-1009 Lake Dr. SE, Grand Rapids, MI 49506
Subjects	Brownfield Redevelopment
	Stormwater Management
	Social Benefits
	Materials Use
	Funding Sources
Total project costs	$800,000 (building shell)
Building square footage	7,200 sq. ft.
Cost / square foot	$111 / sq. ft.

Grand Rapids, Michigan

East Hills Center

History

Located at the center of five different neighborhoods and four business districts, the site of the East Hills Center was a prime piece of real estate. The site had been abandoned for over 15 years and was badly contaminated when, in 2002, Guy Bazzani partnered with the East Hills Neighborhood Association to purchase and redevelop it. Today the property is home to a brand new 7,200-square-foot commercial building with zero stormwater discharge and superior energy efficiency. The tenant-owners are proud to be part of what is rapidly becoming the focal point of the community.

The property was originally home to three residential properties and, in 1932 the properties were converted into a single gas station site. The site remained a gas station until Shell Oil Company shut it down in 1987, and razed it in 1989. After lying vacant for 15 years, the soil was severely contaminated by the leaking underground storage tanks of the former gas station. For many years, Shell tried to get rid of the property in bulk with other vacant sites, but could not find a willing buyer. In 1994, a neighboring business could not get a loan due to the contamination of the Shell site, convincing the East Hills Neighborhood Association to pursue Shell Oil to clean up the site.

In 1998, Shell Oil Company sold the site to Cherokee Festival Holdings, a holding company in California. In 2001, Cherokee began shopping the property around to large fast-food franchises, refueling the neighborhood association's campaign to find a property owner to work in cooperation with the surrounding businesses.

In February 2003, Bazzani became the official owner of the site, deeding the design rights of the future exterior building to Neighborhood Association, thus protecting the neighborhood's historic character for perpetuity. Now almost complete, the mixed use Center is home to two businesses and one nonprofit: Cobblestone, a clothing shop; Marie Catrib's of Grand Rapids, a gourmet neighborhood bistro; and the offices of the West Michigan Environmental Action Council. The property provides an excellent example of urban infill and brownfield redevelopment, and also serves as a community redevelopment catalyst, motivating the city as well as local business owners to invest in the community, its buildings, and the neighborhood infrastructure, creating a sense of pride for local residents.

brownfield - *Abandoned, idled, or under-used industrial and commercial facilities/sites where expansion or redevelopment is complicated by real or perceived environmental contamination.*

Brownfield Redevelopment

Bazzani Associates purchased the site, with a stipulation that Shell would cover all remediation costs. A Baseline Environmental Assessment (BEA) determined the level of existing contamination, prescribed remediation strategies, and protected future owners from liability. Upon completion of the BEA, Shell spent $520,000 on site remediation before the Michigan Department of Environmental Quality (DEQ) signed off on the redevelopment of the site.

As part of Shell's clean up efforts, the contaminated soil was removed from the site and hauled to a toxic waste dump. Additionally Shell used a bioremediation technique of hydrogen-peroxide injection commonly used to clean up petroleum ground water and soil contamination. The presence of hydrogen peroxide in the groundwater and soil increases available oxygen which, in turn, increases the microbe activity and the breakdown of the petroleum hydrocarbons present in the soil and groundwater.

Before construction started, Bazzani installed a 60-mil polyethylene liner six feet below the footings of the building. The liner spans the entire footprint of the building plus three feet in all directions, and is designed to divert any remaining hydrocarbons rising from beneath the building away from its footprint. Otherwise, the hydrocarbons could seep through the foundation and make their way into the building itself.

Stormwater Management

Stormwater runoff is fast becoming a significant problem for city sewer- and water-processing systems and may lead to the contamination of drinking water. Had the East Hills Center followed a traditional design process, it too would have contributed to the stormwater runoff problem; however, Bazzani pursued a different route. When completed, the EHC will have zero stormwater discharge into the city's sewer system. A green roof covers the entire building and a rain garden in the parking lot filters all surface runoff before it reaches the water table.

Before any construction could begin, Shell had to remove all contaminated soil from the site.

bioremediation - *The use of living organisms to clean up oil spills or remove other pollutants from soil, water, or wastewater.*

green roof - *A roof of a building which is partially or completely covered with plants. It may be a tended roof garden or a more self-maintaining system. Green roofs increase roof life span, reduce stormwater runoff, reduce the urban heat island effect, and provide amenity space for building users.*

The green roof on top of the East Hills Center offers better energy efficiency, reduced water runoff as well as less maintenance over the life of the roof.

As part of the agreement with the DEQ regarding the redevelopment of the once-contaminated site, Bazzani agreed to cap the entire site to prevent migration of soil contaminants and to eliminate direct contact with any remaining contamination. After negotiating with the DEQ, Bazzani installed the rain garden which technically did not need to be capped. The two parties agreed that laying 14" of clay soil below the topsoil of the rain garden satisfied the capping requirement for the site. The rain garden cost Bazzani about $8,000, and should last for 50 years with only minor maintenance and trimmings.

The green roof, a Carlisle-Syntec green roof system, was installed in October 2004, using multiple varieties of Sedum that absorb rain water and minimize runoff from the building. As for the life expectancy of the roof system, the dirt and garden, with periodic replanting and minimal maintenance, can last forever. Bazzani expects the roof membrane that runs underneath the system to last 30 to 40 years or longer. Such roofing systems carry a 15-20 year warranty, and this one costs roughly $37,000.

Social Benefits

The local community initiated the campaign to save the East Hills Center site, and Guy Bazzani understood the importance of community involvement. Recognizing the vested interests that the surrounding businesses and residents had in the future of the property, Bazzani implemented a community-based planning approach, allowing all stakeholders to remain involved in the process. During the pre-design stage, Bazzani hosted a design charrette for local business owners, residents, and non-profits to help shape the design of the East Hills Center. As the process progressed, Bazzani continued to work with the Neighborhood Association to solicit feedback and shape the building to meet everyone's needs.

Further supporting the community and creating a more stable local economy, Bazzani chose to set up the five units in the EHC as condominiums and to sell them rather than rent them. By offering ownership of the units, the EHC development created a sense of pride for the new owners. From Bazzani's perspective, not only was he helping the community and the local business owners, he was better able to cover his construction costs which increased as a result of the brownfield remediation and stormwater-management technologies that needed to be implemented. The units sold at 10-20% premium over appraised value which Bazzani attributes to three factors:

1. Benefits of ownership,
2. Contextual fit of the design with its surroundings, and
3. Positive attributes of the sustainable technologies implemented.

rain garden - *A landscaping feature that is planted with native plants and is used to manage stormwater runoff from impervious surfaces such as roofs, sidewalks, and parking lots.*

design charrette - *An intensive design process that involves the collaboration of all project stakeholders at the beginning of a project to develop a comprehensive plan or design. Although it may take place only over a few short days, it establishes groundwork for communication and a team-oriented approach to be carried throughout the building process.*

Materials Use

Material choices were driven by the motivation to obtain LEED Silver certification for the core and shell of the building. All of the exterior and primary interior walls were built using Eco-Block Insulating Concrete Forms (ICFs) consisting of concrete poured between two sheets of expanded polystyrene panels (construction grade Styrofoam). The Eco-Block system used in the East Hills Center provides an insulation value of R-24 and reduces tenants' utility bills. Furthermore, the walls offer superior sound dampening which is important to retail and commercial tenants.

To further improve the sustainability of the building, Bazzani chose to use high fly-ash concrete, using a waste product from coal-fired electrical generation industry that otherwise would be sent to a landfill. The concrete used for the project was supplied by Consumers Concrete. Bazzani simply told Consumers that he wanted a high fly-ash concrete, and Consumers created the mix to match the requirements of the building design. According to Nathan Gillette of Bazzani Associates, the fly-ash concrete demonstrated incredible strength. The targeted design strength for the concrete was 3,500 psi. On day seven, the crush test came in at 4,200 psi, and on day 28, the crush test was near 5,700 psi, vastly exceeding the target.

Another innovative design aspect was Bazzani's use of passive solar design throughout the building. The south facing building proved the ideal setup for the use of light shelves, which provide shade in the summer months to keep the building cool and reflect daylight deep into the building all year round. By increasing the daylight that reaches the depths of the building, not only is more natural light provided, the building requires fewer, less powerful, installed lights, resulting in decreased electricity bills.

Funding Sources

As part of the community's involvement with the project, Bazzani deeded the design rights for the building back to the East Hills Neighborhood Association in exchange for the $32,000 that it had raised towards the purchase of the site. The State of Michigan Cool Cities Initiative selected the project as the recipient of a Catalyst Grant, providing Bazzani Associates with $50,000 towards the development of the East Hills Center. The grant also provided the Neighborhood Façade Improvement Program with $30,000, and $20,000 toward a way-finding program, both of which benefited the East Hills Center project by improving the facades of neighboring businesses and by providing a unified image for the neighborhood.

Awards

- Michigan Cool Cities catalyst grantee
- LEED-Commercial interior - Platinum is goal (West Michigan Environmental Action Council office)
- LEED-Core and Shell - Gold

passive solar - *Systems that collect, move, and store heat using natural heat-transfer mechanisms such as conduction and air convection currents.*

light shelves - *A daylighting strategy that allows natural light to bounce off a shelf located in a window and onto the ceiling to bring light deep into the interior of a space.*

way-finding program - *A process of using spatial and environmental information to find one's way around, a critical element of easily navigating buildings and campuses.*

The Bottom Line

The East Hills Center demonstrates two key points: (1) along with the challenges that come with a brownfield redevelopment project, the engagement of stakeholders is crucial and significant liability issues need to be dealt with; and (2) the project demonstrates the power that a community can exert when efforts are coordinated. The East Hills Neighborhood Association managed what many would consider impossible and, in the end, everyone is better off as a result of their efforts.

This sign was developed by the Neighborhood Association to rally support during the negotiations with Shell.

References

Interviews with Nathan Gillette and Rachel Lee

Bazzani Takes Green into the Mainstream, West Michigan Commercial Development & Real Estate Quarterly, November 1, 2003

Uptown's Cool City District, Bazzani Associates

Contact Information

Design / Builder	Bazzani Associates www.bazzani.com
Nathan Gillette	AIA, LEED-AP, CNU, Project Design Manager, Bazzani Associates, (616) 774-2002, nate@bazzani.com
Rachel Lee	Neighborhood Development Liaison, Bazzani Associates, (616) 774-2002, rachel@bazzani.com
Business Owners	Marie Catrib's of Grand Rapids: (616) 454-4020
	Cobblestone: www.cobblestonehome.com (616) 774-3483
	West Michigan Environmental Action Council: www.wmeac.org

Resources for further information

Syntec Rooftop Planting Systems - www.carlisle-syntec.com

Insulated Concrete Forms www.eco-block.com

Consumers Concrete Corporation - www.consumersconcrete.com

For more information on bioremediation: http://water.usgs.gov/wid/html/bioremed.html







educational

The heart of the Everett Marshall Building seamlessly integrates material use (linoleum, recycled plastic fabrics), lighting efficiency (skylights, open floor plans), and social opportunities (common seating areas, long views).

Project type	Educational
Project scale	Building
Construction type	New Construction - Urban Infill
Date completed	August 2000
Address	Eastern Michigan University, Ypsilanti, MI
Subjects	Materials Use
	Social Benefits
	Funding Sources
	Energy Efficiency
	Lessons Learned
Total project costs	$14 million; interiors and technology: $2.2 million
Building square footage	75,000 sq. ft.
Cost / square foot:	$187 / sq. ft. (overall) $29 / sq. ft. (interiors and technology)

Ypsilanti, Michigan

Everett Marshall Building

History

An early example of green development in Michigan, the Everett Marshall Building at Eastern Michigan University (EMU), exemplifies for students, faculty, and visitors the sound principles of universal design and environmental sensitivity. The building opened in the fall of 2000, and although the shell of the building was not constructed to be green, the designer and project team extensively researched sustainability and indoor air quality issues for the FF&E (furniture, fixtures, and equipment).

Louise Jones, a professor of Interior Design at EMU and creator of the interior plans for the Marshall Building, was motivated by environmentally responsible design, a concept that combines sensitivity to human health issues with concern for ecological health. The philosophy of universal design meets and surpasses the Americans with Disabilities Act compliance regulations and underlies the plans for the Marshall Building, setting it apart as a unique example of sustainable development in an institutional context.

"Five years ago, the cost of green building came at a higher premium, but now a lot of green products are comparable [in price] with traditional products."

Lynn Rogien

Materials Use

For the Marshall Building, the design team carefully selected sustainable flooring and furnishing materials. These materials were chosen based on their recycled content, their ability to be recycled in the future, and the sustainability of their production methods. In some cases, the green materials chosen for the project were less expensive than their traditional counterparts because they were made from materials diverted from the waste stream. Ordering green materials in 1998 was challenging, says Jones, because nobody was familiar with them; today the challenge arises from a company's tendency to greenwash their products, leaving the consumer with the responsibility to search out the best sustainable materials.

The variety of environmentally responsible flooring materials used throughout the Marshall Building illustrates the durability and attractiveness of going green. Cork flooring provides excellent insulation and sound absorption properties and lasts for decades without showing significant wear. A renewable resource, cork is sustainably harvested from live trees and can be re-harvested every 10 years for approximately 200 years. Similarly, bamboo grows rapidly and is continually harvested to provide attractive, stronger-than-steel flooring planks. Linoleum, used in the high-traffic hallways of the Marshall Building, incorporates renewable natural components into long-lasting flooring material with natural bactericidal properties.

Madera tile, a wood composite material, looks like natural slate without the weight, brittleness, or cold feel of stone. These tiles are harder than hardwood flooring, moisture-proof, and warranted for durability. The bathrooms of the Marshall Building feature textured Crossville Eco-Cycle tile, a porcelain tile made from 95% factory-recovered waste clay. The manufacturer offers this easy-to-clean, attractive tile at a reduced cost because it is generally considered production waste.

Office cubicle partitions from Knoll's Equity product line incorporate recycled and recyclable materials, including gypsum substrates and fabrics made from pop bottles, all constructed without harmful adhesives. Metal surfaces of cubicles, tables, and chairs feature a powder-coat finish that reduces wasted paint during production. Desktops in faculty offices are either biocomposite materials or recycled urban wood (i.e., shipping pallets) sealed to prevent off-gassing. Most of the office chair fabrics and frames were once pop bottles. The suppliers shipped the furniture using blankets as protection, removing the need for packaging waste.

Linoleum flooring made from linseed oil, wood flour, and pine rosin presents a durable and attractive appearance in hallways and common areas.

greenwash - *Also called faux green; to falsely claim a product is environmentally sound.*

biocomposite - *A synthetic material composed of various natural components.*

off-gassing - *The emission of chemical compounds from a newly-painted, finished, carpeted, or furnished room into the air.*

In this office area, recyclable cubicle elements, biocomposite desktops, and Solenium flooring surround occupants with green materials.

The DesignTex Corporation in cooperation with William McDonough, an industry leader in sustainable design, created many of the fabrics used throughout the Marshall Building. In typical fabric processing, over 8000 chemicals are used; of these, only 32 chemicals have no adverse effect on human or environmental health. The wool-and-ramie chair fabric in the Marshall Building furniture uses these green chemicals. Waste from this fabric production process becomes garden mulch and is fully compostable.

Solenium, "resilient textile flooring" from Interface, looks like carpet but behaves like tile: it can be vacuumed and wet-mopped and provides an attractive floor for Marshall Building office areas. Solenium is produced from recycled materials and can be completely recycled as Solenium flooring. In fact, Eastern Michigan University leases the floor from Interface, which collects the tiles, separates the layers, and creates new product after the useful life of the existing system.

Social Benefits

A primary motivator for the interior design of the Marshall Building was the concept of universal design. Moving beyond the requirements of the ADA or the accommodations of barrier-free design, universal design seeks to allow all persons, regardless of ability, weight, height, or age, equal access to a facility and its amenities. As implemented in the Marshall Building, this concept appears in the selection of wider doorways, height-adjustable chairs and tables, bi-level teaching podiums with two sets of controls for educational technology installations, easily-movable classroom furniture, and open-access areas in lecture halls where fixed seating predominates, in addition to typical installations such as an elevator and accessible bathrooms.

Universal design is also concerned with maintaining high indoor air quality (IAQ) levels. The most basic solution for IAQ is to use paints that contain low levels of volatile organic compounds (VOCs), which do not release harmful chemicals into the closed indoor environment. Low-VOC flooring adhesives, interior paints, and furniture finishes help maintain good IAQ. In the Marshall Building, mold-inhibiting ceiling tiles and a voluntary fragrance-free policy for those in the building maintain indoor air quality at a higher level than outside the building (based on OSHA tests).

VOC - *Volatile organic compounds; Secondary petrochemicals which evaporate readily into the atmosphere at normal temperatures. They include light alcohols, acetone, trichloroethylene, perchloroethylene, dichloroethylene, benzene, vinyl chloride, tolulene, and methyl chloride. These potentially toxic chemicals are used as solvents, degreasers, paint thinners, adhesives, and fuels and contribute significantly to photochemical smog production and certain health problems. Signs and symptoms of VOC exposure may include eye and upper respiratory irritation, nasal congestion, headache, and dizziness.*

Funding Sources

The sustainable interior design of the Marshall Building faced a double hurdle from a financial perspective. At the time of construction, state universities faced state-imposed budget restrictions. Additionally, green materials were relatively new to the building market and only available at higher costs. The University was willing to pay for standard materials, but the designer wanted environmentally responsible materials. The project manager, The Christman Company, offered to double-bid traditional and green materials to demonstrate cost differences.

Upon seeing the cost comparisons, the University funded some of the green materials; a private grant for the construction of the building covered many of the other material costs. "Five years ago, the cost of green building came at a higher premium," says Christman's Lynn Rogien, "but now, a lot of green products are comparable [in price] with traditional products." Low-VOC paints do not cost appreciably more than regular paints; the cost difference in flooring materials varies, but life cycle costs need to be included in the comparison.

Energy Efficiency

Energy efficiency is a wise choice when working within a tight budget. Up-front investments in efficient lighting and heating systems save costs and reduce energy demand. In addition to daylight meters and occupancy sensors that turn off lights, building and interior design contributes to efficient energy use. In the Marshall Building, office floors are different colors (green or gold) throughout the building; darker floors absorb solar heat while lighter floors prevent sunny offices from becoming uncomfortably warm. The two main entrances to the building incorporate double-door airlocks that minimize heating and cooling loss, and a prominent central staircase encourages students, faculty, and staff to use human energy instead of an electrical-powered elevator to move between floors.

Lessons Learned

One challenge still faced by the occupants of the Marshall Building involves the regular cleaning and maintenance of the environmentally responsible building. As is typical in an institutional setting, custodial services change periodically as the University continually bids out the work. Due to the nature of the green materials (e.g., no need to wax some floors) and the desire to maintain healthy indoor air quality, new custodial crews must learn the proper use of green cleaning products.

The prominent location of this recycled-rubber staircase encourages walking instead of elevator use.

"If the project team takes a system-wide, integrated approach to green materials and considers life cycle costs, LEED silver [certification] can be attained at little to no cost increase."

- Lynn Rogien

The Bottom Line

As demonstrated by the Everett Marshall Building, environmental responsibility can be incorporated into a tightly budgeted project. "Green materials don't cost more to use," says Lynn Rogien, "if you are smart about their use and take the time to get educated. If the project team takes a system-wide, integrated approach to green materials and considers life-cycle costs, LEED silver [certification] can be attained at little to no cost increase." Knowing why an individual wants to pursue green development (e.g., energy efficiency) and stressing this reason throughout the renovation process leads to successful projects.

Home to the College of Health and Human Services at Eastern Michigan University, the Marshall Building boasts an environmentally responsible interior design and the distinction of being a Michigan green building pioneer.

Educational signage displayed throughout the building informs occupants of the benefits of green development.

Contact Information

Client	College of Health and Human Services, Eastern Michigan University, Ypsilanti, MI
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Interior Designer	Louise Jones, Arch D., LEED AP, Interior Design Program Director, Eastern Michigan University, Ypsilanti, MI, louise.jones@emich.edu

References

Guerin, Denise, Louise Jones and Delores Ginthner. (2004). "Environmentally Responsible Interior Design: A Case Study." eJournal of Interior Design, 30(3).

Students at Zeeland West High School not only learn from their teachers, but also gain an education in sustainable living from the building and natural environment around them.

Project type	Educational
Project scale	Building
Construction type	New Construction - Greenfield
Date completed	August 2002
Address	3390 100th Avenue, Zeeland, MI, 49464
Subjects:	Energy Efficiency
	Stormwater Management
	Funding Sources
	Lessons Learned
Total project costs	$25 million ($16.2 million building costs)
Building square footage	173,500 sq. ft.
Cost / square foot	$144 total / sq. ft. (building alone: $93 / sq. ft.)

Zeeland, Michigan

Zeeland West High School

History

In the fall of 1996, residents of Zeeland, a fast-growing community on Michigan's west coast, opened a new high school facility, Zeeland East High School. Soon after, however, district officials realized that the district would need additional space in the very near future. In 2002, after receiving approval for a bond issue, the second high school building, Zeeland West High School (ZWHS), opened next to the 1996 building. The dual facility provides classroom space for over 1500 students, with room for expansion planned into the site design.

The school district wanted Zeeland West to be "a high performance school for high performance students." Energy savings, achieved through building design and on-site power generation, provide the community with a public building that respects the environment and fulfills the goals set out by the school district. Green elements–including photovoltaic panels, a geothermal heat exchange system, and a wind turbine–allow teachers to integrate environmental awareness into their curricula. "The building is like a textbook," says project engineer Steve Hamstra.

"We, as architects, need to realize that the spaces we design impact the quality of people's lives."

Steve Hamstra

photovoltaic - *(PVs) Solid state cells (typically made from silicon) that directly convert sunlight into electricity.*

geothermal - *Geothermal power is energy generated by utilizing naturally occurring geological heat sources. It is a form of renewable energy.*

Energy Efficiency

The geothermal system at Zeeland West comprises 20 miles of pipes extending 400 feet into the ground. Instead of using the more common propylene glycol, the heat exchange medium is potable water; in the rare event that the system develops a leak, the risk of environmental damage is minimal.

From the start, the school district recognized that an energy-efficient building would result in significant cost savings over the life of the school. For educational facilities, utilities are typically the second or third highest expenses. By integrating energy conservation with on-site generation, ZWHS saves $40,000-$50,000 each year on energy costs alone. The reduced maintenance costs associated with the energy efficiency improvements are difficult to quantify but no less significant; the district saves an estimated $20,000 per year through less frequent mechanical-system repairs and light bulb replacements.

Throughout the planning process for Zeeland West, the designers worked to reduce energy costs by reducing energy loads. The long axis of the school is oriented east-west, minimizing the negative effects of solar gain while maximizing opportunities for daylight harvesting. High-performance windows with specially designed shades admit daylight to classrooms and office spaces while reducing unnecessary solar heating. Interior science laboratories lack outside windows, but employ clerestories to bring daylight into these spaces. Throughout the new school, low-energy artificial lighting contributes to the building's reduced electricity demand, even in the gymnasium where high-efficiency fixtures use 41% less energy than typical gym lights.

District guidelines specify that schools have black rubber roofs to maximize solar heating in the winter, even though snow covers the roofs for most of the season and black roofs retain summer heat. With the installation of a white roof made of thermopolyolefin at ZWHS, the cooling load of the building was cut in half, and insulating the roof to increase its R-value resulted in an additional 25% energy savings. To save energy, occupancy sensors and automatic thermostats in each room in the building turn off lights and lower room temperatures to save energy.

The simple action of using light-colored roofing materials reduces the absorption of solar radiation and the energy costs to counteract associated heating.

white roof - *A daylighting strategy that allows natural light to bounce off a shelf located in a window and onto the ceiling to bring light deep into the interior of a space.*

R-value - *Low-emissivity windows: glazing that has special coatings to permit most of the sun's light radiation to enter the building, but prevents heat radiation from passing through.*

The wind turbine at Zeeland West High School represents the collaboration of numerous individuals and firms, including the utility company, local contractors, and the school district.

A collection of innovative energy-harvesting equipment allows Zeeland West to decrease its dependence on purchased electric and gas power. A 120-loop geothermal exchange system located under the marching band practice field provides a stable source of winter heating and summer cooling. Photovoltaic panels produce power from sunlight, and their installation at ground level, instead of on the roof, slightly decreases their efficiency but allows for direct student observation. A 10kW, 23-foot-diameter wind turbine mounted on an 85-foot tower behind the school converts wind power into electric power, saving the district $1,200 each year on electricity costs.

In energy comparisons of schools throughout the state, Michigan does not factor the presence of air conditioning units into its calculations. Located in the southern part of Michigan, ZWHS is fully air conditioned (including the gymnasium); however, with its energy-saving equipment, the school uses only two-thirds the energy of the average Michigan school. The public has enthusiastically accepted this "green" high school, finding it more comfortable than Zeeland East and shifting many programs to the new building. This extended use results in additional operating hours and energy use at ZWHS, but the school is still 25% less energy consumptive than other schools.

Stormwater Management

While Zeeland West High School's primary green development emphasis focuses on energy efficiency, elements of the site design and landscaping contribute to responsible stormwater management as well. By siting the new school adjacent to the existing Zeeland East campus, the district shares parking, building, and athletic facilities between the two schools, reducing the need for additional impervious surfaces on the site. A recent initiative involves replacing 11 acres of turf grass with native prairie plantings. This conversion will decrease stormwater runoff, provide additional educational opportunities, and save the district more than $250,000 (in reduced maintenance) over 10 years.

Funding Sources

Funding for the ZWHS project came from a variety of sources. The initial revenue was generated in 1999 from a $39 million bond issue passed by local residents. AEP, a regional power company, provided a $5,000 grant for the photovoltaic panels. The on-site wind turbine came from donations from individuals and organizations. A grant from the Zeeland Board of Public Works, along with services donated from a local electrical contractor, covered the installation costs. Another local contractor donated a tower to the school to mount the turbine. In the end, Zeeland West's project costs were below average to average for a Michigan high school.

"Well-designed, energy efficient mechanical systems cost from zero percent to a maximum of ten percent more. The key is designing a building to minimize the need for mechanical systems."
-Steve Hamstra

Lessons Learned

Zeeland West High School's design is progressive and the project marked the first sustainable school construction project in the state. Other schools across Michigan have embraced principles of green development since, but ZWHS stands as a model of environmentally sound choices in an educational facility. Based on the success of this project, the local school district changed its collective view of facility management, and the board of education included sustainable operation as one of its five overall goals.

GMB Architects-Engineers, the architectural and engineering consultants for the project, discovered the importance of up-front education to the process of green development. Zeeland West was GMB's first large-scale geothermal project, requiring those involved-GMB, the school district, and the contractors-to learn about installation and operation procedures. A pre-bid information session for potential contractors minimized the chances of "surprise" costs derailing the project.

After completing construction and opening the school, the project team realized that the daylight harvesting controls posed a challenge to effective calibration and operation. Building users needed to learn to properly use the low-energy lights. From this, GMB learned that in the future, artificial lights needed to stay on, although dimmed, even when not needed, so that building occupants would not think the lights were broken.

For ZWHS, integrated design allowed mechanical systems to be "right-sized," saving on both capital and operating costs by not installing more capacity than necessary. Steve Hamstra from GMB says, "Well-designed, energy-efficient mechanical systems cost from 0% to a maximum of 10% more. The key is designing a building that minimizes the need for mechanical systems." Examining the design early in the project allowed the project team to work together efficiently and to avoid over-designing the building's mechanical systems.

Zeeland West High School not only provides a place for learning, but serves as a learning tool itself. Through the Internet, students monitor in real-time the geothermal system, photovoltaic panels, wind turbine, and the building's overall energy use. The impact of changing weather conditions on the school's power generation and use is tracked and teachers are able to incorporate this information into the school's science curricula.

Integrating the power generation and energy use monitoring programs into the curriculum at Zeeland West HS give students the unique opportunity to more closely observe and understand the link between humans and the environment.

"The building is like a textbook, not just a receptacle for education."
- Steve Hamstra

The Bottom Line

Zeeland West High School set the standard as the first "green" school in Michigan. The incorporation of energy-saving and energy-producing features into an educational building demonstrates the feasibility and desirability of green development and, at the same time, provides environmental awareness to students, parents, faculty, and the community. Steve Hamstra believes that architects can learn from this project by recognizing that "the spaces we design impact the quality of people's lives." Designing sustainable spaces and facilities positively impacts communities for years to come.

Lighting in large areas, such as school gymnasiums, often accounts for a large portion of utility costs. In the gym at Zeeland West High School, lights are only used when needed instead of remaining on throughout the day (as is typical with older gymnasium lighting).

Awards

- Association of School Business Officials Certificate of Excellence (awarded to GMB), October 2003, New K-12 School Building category

Contact Information

Client	David Van Ginhoven, Asst. Superintendent of Business, Zeeland Public Schools, Zeeland, MI, (616) 748-3006, dvanginh@zeeland.k12.mi.us
Architect / Engineer	Stephen Hamstra, P.E., LEED AP, GMB Architects-Engineers, Holland, MI, (616) 796-0200, steveh@gmb.com

Architects integrated natural features and common walking space outside of the school to encourage more connection with the outside environment.

Project type	Education
Project scale	Building
Construction type	New Construction - Greenfield
Date completed	August 2004
Address	2200 Pettis NE, Ada MI
Subjects	Energy Efficiency
	Materials Use
	Social Benefits
	Lessons Learned
	Cost Benefit Analysis
Total project costs	$25,385,000
	(land & furniture excluded)
Building square footage	214,000 sq. ft.
Cost / square foot	$118 / sq. ft.

Grand Rapids, Michigan

Forest Hills Eastern High School

History

The guiding principle of Forest Hills Eastern High School / Middle School building design was to create a self-directed, collaborative, and technology-enriched environment for students now and into the future. The design needed to improve utilization and energy efficiency beyond the standard that currently existed in school buildings. The school would open as a 7th -12th grade building and migrate to a 9th -12th grade building to include thematic "schools within a school", with flexible teaching and studio spaces.

Unique spaces within the school include Interactive Learning Centers, the Great Hall, and the studios. These are spaces that enhance the educational environment through their flexibility, variety, and use of wireless technology. The Interactive Learning Centers are student- teacher collaborative spaces incorporated within each of the building's academic wings. They are technology-rich spaces designed to facilitate large group presentations, small group study, and quiet individual research.

The Great Hall, like the Greek Forum, is a place for "seeing and being seen," for academics, for social interaction, for meeting friends, sharing a meal, and for building community. Ideally, all of these activities happen simultaneously within this space.

The studios are designed to accommodate a multitude of enrichment programs, and thus are the most flexible spaces in the building. The studios are larger than the classrooms and equipped with additional storage, enhanced technology and power infrastructure, and plumbing. Their exposed structure ceilings and movable partitions provide additional volume for the space.

The classrooms are consciously designed to be different from classrooms of the past. They utilize large double doors open to the Interactive Learning Center, a mobile teaching station for the instructor, and wireless technology to encourage collaborative and project-based learning.

"I really wanted to be involved in the development of the new Forest Hills Eastern High/Middle School from the beginning. URS listened to what we asked, and because of their careful designing and Barnes Management's ability to bring the project together so fast, we've got a school with cutting edge technology that has been specifically designed to optimize the students' learning experience."

- Linda LaBerteaux, Principal of the New Eastern High/Middle School.

Energy Efficiency

Active energy efficiency design decisions at Forest Hills Eastern include:
(1) energy efficient lighting,
(2) tiered lighting control,
(3) a building energy recovery system,
(4) an energy management system, and
(5) a comprehensive building-commissioning program.

The building design responded to existing site constraints by carefully considering the building's placement on the site, the development of the building section and footprint, the use of operable windows whenever possible, the creation of an efficient HVAC system, and an innovative utility solution. The building section was designed to take advantage of the existing change in the site's topography--moving from southwest (low) to northeast (high). The building maximizes this grade change to control the safety and security of the entry, enhance the spatial impact of the entry sequence, and provide the best view of the rest of the site to the Great Hall.

Examples of creative material use include burnished and glazed block throughout the interior in place of painted block, steel frame construction which allows for quick and efficient change of the interior partitions, a white roof membrane to increase solar heat reflectivity, concrete paving instead of asphalt paving, sun-shading devices on the southwest elevation, and porcelain ceramic tile.

Passive energy efficiency design decisions include: (1) building envelope insulation to meet or exceed industry norms, (2) white EDPM roof to reduce thermal heat gain, (3) the introduction of natural light deep into the building, (4) shading devices to control thermal gain through fenestration, (5) gas-filled insulated low-E glass, (6) an irrigation retention pond, (7) concrete paving instead of asphalt paving, and (8) on-site constructed wetlands instead of a public sewer connection.

An onsite gravel mining operation supplied the needed gravel requirements for the site. This approach was possible because of the site's soil composition and the expertise of the site excavator. The on-site operation was identified as both a cost-savings opportunity for the school, and as a means to reduce fuel consumption for transporting materials to the site.

In addition, the site's irrigation retention pond is supplied by a horizontal well located uphill from the pond, eliminating the need for a traditional well. This system captures subsurface water to maintain the pond's capacity, removes the need to tap into the area's aquifer, and eliminates the pump required to maintain the pond's operational level. The project also includes an on-site sewage treatment system for reduction in sanitary waste water to the city's sewer.

Teacher and student absenteeism runs as much as 40 percent lower in schools with fresh ventilation and lots of daylight. They also tend to feel happier and more contented at school. (Source: Environmental Protection Agency, The Indoor Air Quality Solution)

white roof - *A daylighting strategy that allows natural light to bounce off a shelf located in a window and onto the ceiling to bring light deep into the interior of a space.*

low-E glass - *Low-emissivity windows: glazing that has special coatings to permit most of the sun's light radiation to enter the building, but prevents heat radiation from passing through.*

Natural sunlight through the windows decreases overall lighting energy expenses for Forest Hills.

Materials Use

Forest Hills Eastern High School / Middle School implemented creative techniques to maximize energy output and savings by using innovative materials and design processes. The school is served by a central chilled water system and a central heating water system that transfers energy out to the building. The building has eleven main air handling systems that heat and ventilate the entire building. Ten of the eleven systems (gymnasium excluded) are conditioned by the chilled water system and the central chilled water system incorporates thermal ice storage for off-peak chilled water generation. The ice storage tanks have a storage capacity of 1725 ton-hours. The use of ice storage allows the building to reduce both electrical demand and overall energy costs. The ice storage system uses a chiller to make ice at night when electric utilities lower their rates. Chilled water is generated by a 330-ton packaged air-cooled chiller. Both chiller and storage tanks sit outside in the chiller yard.

Electrical System Features

The Forest Hills Eastern High School/Middle School building is served by a 2500-amp main electrical distribution system, at 480Y/277V, 3 phase, 4 wire. The distribution equipment is centrally located to deliver power to the many different wings of the structure. All feeder conductors were designed to have a maximum voltage drop of 2% or less. Branch circuit conductors were designed to have a maximum voltage drop of 3% or less.

The central heating plant is powered by five gas-fired modular boilers. The modules allow the boilers to match the system load over a wide range. Using modular boilers provides a high level of redundancy and ease of future replacement. Each module achieves a thermal efficiency of 88%.

Ventilation is delivered to the building using two distinct strategies. For areas which have a consistent occupancy load, such as classroom wings, media center, and music areas, there is a constant ventilation rate. The ventilation air is pre-treated through one of seven energy recovery units, reducing heating and cooling needs. For areas with large fluctuations in occupancy, such as the Great Hall and gymnasium, the occupancy is determined by the level of carbon dioxide in the space. The ventilation dampers modulate to maintain an acceptable level of carbon dioxide.

The interior lighting controls combine multiple switching, occupancy sensors, an energy management system, lighting contactors, and time switches to provide an increase in energy savings with the ability for user intervention, ease of use, and flexibility. The interior lighting power allowance, determined by using a space-by-space method, illustrated that the majority of the areas had lighting power densities that were equal to, or less than, requirements of ASHRAE 90.1-1999.

Exterior lighting is controlled by the building energy management system with control input from photocells and occupancy, and building use schedule. Maximum energy efficient security illumination is provided at building entrances, exits, and parking lots. Electric vehicle recharging stations were installed at the base of the parking lot light poles to accommodate 3% of the total vehicle parking capacity.

Social Benefits

Sustainably-built schools have health, social, and educational benefits. School facilities that have ill-advised designs, inadequate ventilation, poor acoustics, dim lighting, and inefficient heating and cooling systems can create conditions that impair a student's ability to learn. In fact, recent research reveals a strong connection between the use of daylighting in school buildings and student performance. Incorporating natural daylight was a main objective for Forest Hills and the architects made efforts to incorporate large windows that would both increase the amount of daylight coming into the building and provide students and teachers with outside views of nature.

According to a recent study conducted by the architectural firm Innovative Design, students clearly benefit from daylighting in school buildings. Benefits include:

Students who attended daylighted schools outperformed students who didn't by 5-14%.

The impact of daylighting exposure increases. Eighth graders improved by 21% between 1992 and 1995, compared to a country average of 10%.

Source: Rebuild America: Helping Schools Make Smart Choices About Energy

Lessons Learned

Early programming meetings with the school district guided the architects design to meet the community's needs. One of the most influential early programming sessions involved input from Superintendent Washburn''s Business Advisory Committee. This group of local business leaders provided insight into the employable skills necessary for success after high school.

After the sessions, it was clear that one of the challenges was to create a facility that was designed to allow for a smooth transition from middle school and high school to the business world. Forest Hills Eastern High School / Middle School meets this challenge by creating spaces that supplement the traditional classroom and encourage unique forms of interaction.

Cost Benefit Analysis

During the planning process, the community decided that a school facility is an excellent place to teach environmental responsibility, and the decision to approach a sustainable architectural solution was driven more by the community desire to do the right thing than by financial necessity. As a result, a formal cost-benefit analysis was not completed.

	Base Building Case	FH Eastern	Savings
Energy Costs	$184,000 / yr	$124,000 / yr	$60,000 / yr ($60,000 / 7years)

"Flexibility, collaboration, and community support were the keys to this successful project."
- Michael Van Schelven, senior project designer for URS Corporation

The Bottom Line

Green building is smart economically, educationally, and socially. Parents, teachers, administrators, and students are increasingly more aware of the benefits of healthy, environmentally sensitive buildings, and the consensus and collaboration help build the new Forest Hills School. Even in a public school system, collaboration towards green building can work. The Forest Hills Eastern High School is a prime example.

Energy efficient lighting is dominant throughout Forest Hills. Large open spaces allow for greater interaction and help to create a stronger community.

Contact Information

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Resources for further information

www.fhps.k12.mi.us/easternhighmiddle/

www.urscorp.com

www.barnesmanagement.com

www.usgbc.com







residential

The Motherhouse retains its historic 1930s appearance while being completely and sustainably renovated inside.

Project type	Residential
Project scale	Building
Construction type	Renovation - Urban
Date completed	January 2003
Address	610 West Elm Avenue, Monroe, MI 48162
Subjects	Energy Efficiency
	Water Efficiency
	Materials Use
	Development Processes
	Social Benefits
Total project costs	$56 million
Building square footage	376,000 sq. ft.
Cost / square foot	$150 / sq. ft.

Monroe, Michigan

IHM Motherhouse

History

In 1845, the Sisters, Servants of the Immaculate Heart of Mary (IHM), founded a ministry of education in Monroe, Michigan. Since then, the IHM community has expanded greatly, teaching in schools and communities throughout the world and promoting a sense of spiritual connection between humanity and the environment. The 280-acre campus in Monroe remains the "home office" of the IHM community. Today, its centerpiece, the 376,000 square-foot Motherhouse, provides space for worship, administrative offices, and residences for aging IHM Sisters whose healthcare needs require special accommodations.

Following the destruction of the previous structure by fire, the existing Motherhouse was constructed in the early 1930s. Despite the hardships of the Great Depression, the community was able to fund reconstruction and employ builders who took great pride in their craftsmanship. The 18-inch-thick brick and concrete walls and the interior spaces of the Motherhouse, finished with terrazzo, Flint Faience tiles, and period chandeliers, convey a sense of elegant permanence. Estimates of the life of the structure extend into the 23rd century.

In the 1990s, the Sisters determined that the Motherhouse no longer met the changing needs of the IHM community. The utility systems throughout the building were outdated and failing; a complete reinstallation of plumbing, electrical, and HVAC systems was required. Faced with the option of building a completely new structure, the Sisters instead chose to renovate the Motherhouse, reusing the site and building shell but replacing most of the interior. By sustainably renovating the Motherhouse, the IHM community emphasized their strong belief in responsible stewardship and educated the construction industry and the general public about the principles of green living.

"Earth-friendly can be done in an old building, and cost effectively."

- Sr. Janet Ryan

Energy Efficiency

The Geothermal System

232 holes, 450 feet deep

54 miles of closed-loop pipe

Underground temperature: 55°

Temperature of water when entering building: 72° (due to friction)

Conversion to energy efficient lighting is one of the least labor intensive components of green development. At the Motherhouse, Depression-era lighting fixtures were adapted to use compact fluorescent bulbs, reducing energy costs and requiring less maintenance. The appropriate lighting was carefully selected for each space, reducing the amount of over-lighting. The large number of windows throughout the Motherhouse allows the residents to take full advantage of natural daylight; the installation of both occupancy sensors and light meters allows the lights to be turned on only when needed. In 2004, despite tripling the building's electrical capacity, the Sisters saved over $187,000 on electricity.

As part of the renovation, 800 windows were removed, refurbished (instead of purchasing new windows), and reinstalled with high-efficiency glass and operating sashes that allow the residents to control fresh air, heating, and cooling in their rooms. In addition to the windows, individual thermostats were installed in each room to minimize unnecessary heating and cooling of large spaces, and a heat recovery system was installed on the ductwork to prevent warmed air from escaping the building.

One of the many unique features of the Motherhouse renovation is the building's source of heating and cooling energy for the building. A closed-loop geothermal energy system circulates water through the building and into the earth, providing heat in the winter and removing heat in the summer. In addition to the thermal mass of the building structure, which evens out the indoor temperature, the geothermal system allows supplemental heating and cooling systems to work less often than typically needed in Michigan. The system, which effectively "uses the Earth as a giant radiator," is the largest residential geothermal field in the country.

Interior spaces combine green technology, such as energy-efficient lighting and low-VOC paints, with elegant features of the Depression-era original construction.

geothermal - *Geothermal power is energy generated by utilizing naturally occurring geological heat sources. It is a form of renewable energy.*

The Sisters chose to refurbish 800 original windows, simultaneously saving costs and reducing wastes. The windows can now be opened, allowing residents to control room temperature and fresh air supply.

Water Efficiency

One challenge to the Sisters' efforts toward sustainability was their desire to convert common bathroom facilities on each floor into private baths in each resident's room, resulting in the installation of 300 new toilets and over 250 individual showers, more than double the previous amount. To counterbalance this increased demand, low-flow fixtures were installed, including showerheads that use only 1.8 gallons of water per minute (a typical shower uses 4.5 gallons per minute (gpm), bathroom faucets that use 1.5 gpm instead of the usual 4 gpm, and high-velocity toilets that use less water per flush.

Water Savings

5000 fewer gal/day as compared to pre-renovation structure

Est. 7500 fewer gal/day as compared to traditional installation of new configuration

In 2004, water bills were 50% less than pre-renovation expenses

Source: IHM Motherhouse

The original 1930s-era plumbing required complete replacement; as a result, the Sisters decided to further reduce their use of potable water by installing a graywater system in the Motherhouse. Wastewater from sinks and showers travels through a separate network of pipes to a constructed wetland behind the building. In 7-10 days, the plants and soils in the wetland filter the graywater, which is then returned to the Motherhouse, marked with a biodegradable blue dye, and used only for flushing toilets throughout the building. Only then, after being used twice, is the wastewater sent to the municipal sewer system.

According to the EPA average water use in the Great Lakes region is 287 gallons per person per day; at this rate, the 210 residents of the Motherhouse would use over 60,000 gallons of water each day. Even without accounting for the thrifty water use of the IHM Sisters, the water-saving renovation measures result in more than 12% less water use as compared to a traditionally built structure.

Materials Use

The Sisters specified the use of many sustainable materials as part of the renovation. New Interface tiled carpets have the dual benefits of not off-gassing after installation and of being easily replaceable if necessary: a single 12"x12" tile can be replaced instead of an entire room. Cork flooring, used throughout the building, is sustainably harvested, provides superior sound-absorption capacity, and lasts for decades without an appreciable loss in quality. Cork was one of the original flooring materials in the 1932 Motherhouse and the tiles that remain today cannot be distinguished from the newly installed cork floors.

Green Building Materials in the Motherhouse

Renewable cork and linoleum flooring

Interface carpeting

Benjamin Moore low-VOC paints

Trex recycled plastic and wood product on veranda

Natural gypsum wallboard

Mineral wool insulation

graywater - *Wastewater discharged from sinks, showers, kitchens, or other non-industrial operations, excluding toilets and kitchen solid-waste disposal systems.*

off-gassing - *The emission of chemical compounds from a newly-painted, finished, carpeted, or furnished room into the air.*

Development Processes

Throughout the renovation process, the IHM community illustrated its commitment to the environment by using sustainable methods and products. Materials removed from the building were recycled, reused in the renovated building, and otherwise diverted from the normal waste stream. Lynn Rogien, of the Christman Company and construction manager for the project, estimates that recycling alone "probably saved 20% in dump fees." Concrete from demolished walls and floors was crushed and used on the site as temporary roads for construction traffic, and removed marble slabs were reinstalled as counters and windowsills.

Eight hundred windows were made operable and reused, along with over 500 refurbished cherry doors. More than 45,000 square feet of carpeting was removed from the old Motherhouse; half of the carpet was recycled and the remainder was sent to an incinerator. Recycle Ann Arbor, a private non-profit organization, hauled away - at no cost - over five truckloads of reusable toilets, sinks, and other materials still of functional use. Rogien said, "We were still sending away the same amount of material [from the site], but it cost us less" to send wastes to a recycler than to a landfill.

Concurrent with the structural renovation of the Motherhouse, the Sisters educated themselves about sustainable site planning and restored much of the campus grounds, preserving working agricultural fields and a unique oak savanna ecosystem present on the site. Five acres of turf grass lawn were converted to prairie meadows, requiring fewer chemical inputs and less overall maintenance, and providing habitat for wildlife. The stormwater runoff from the building, parking lots, and driveways is now handled by a system of vegetated swales that allow the water to percolate into the ground rather than being conveyed off site by storm sewers.

Social Benefits

Part of the sustainability of the Motherhouse and campus comes from its ability to be adaptively reused as the physical needs of the IHM community change. Each resident's room in the Motherhouse was redesigned so that, with the removal of selected walls, the building can be converted to private apartments when no longer needed to house the IHM Sisters. Additionally, plans are being created for the future development of a sustainable community on the campus, organized around a covenant of sustainable principles including pedestrian-focused travel, shared amenities, and common green spaces.

For more than 150 years, the mission of the IHM community has been to educate; this call continues today as the Sisters share their experience and knowledge about green development. The Sisters established a non-profit organization, the River Raisin Institute, to disseminate information on sustainable living, manage a tour program at the Motherhouse, and coordinate a series of speakers and consultation services for organizations interested in implementing sustainability. In the fall of 2005, the Motherhouse will host a conference for construction tradespersons learning how to incorporate green practices and materials into their future building projects.

The renovation project of the IHM Motherhouse succeeded in having a minimal impact on the environment but a profound impact on everyone involved. Sharon Venier, of the River Raisin Institute, says, "The IHM community, architects, construction company, and its subcontractors learned together how sustainable renovation and restoration can have [a] beneficial environmental impact." As with the 1930s construction workers involved in building the original Motherhouse, the contractors and tradespersons who worked on the Motherhouse renovation carry with them a sense of pride and a new understanding of the impacts of their work. "The contractors and subcontractors who worked on this project are now, in turn, implementing earth-friendly practices on other projects, thus changing the marketplace of the future," says Venier.

Awards

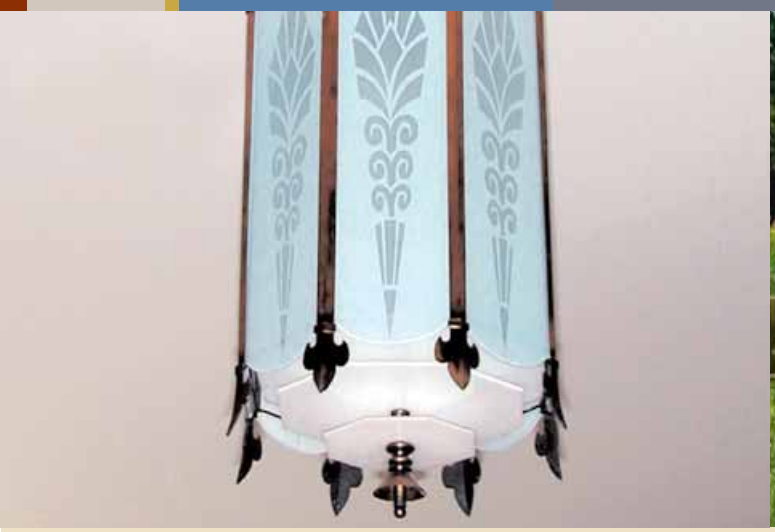
- 2003 EPA Clean Air Excellence award - Community Projects category
- 2003 Build Michigan award - Over $5 million category
- Michigan Historic Preservation Network Building award
- Registered for LEED certification (silver certification expected)

"The Sisters gave us an education on what green was."

- Lynn Rogien

The Bottom Line

Sister Janet Ryan, a member of the project team, promotes the Motherhouse renovation as an example of how "Earth-friendly [renovations] can be accomplished in an old building, and [accomplished] cost effectively". While its sheer magnitude places the project in a unique class, the opportunities for demonstrating innovative sustainable systems makes the Motherhouse renovation an extraordinary example for developers throughout the state. A truly sustainable practice propagates itself by demonstrating its benefits and educating others; by that measure, the IHM Motherhouse will positively impact the environment and the community for generations to come.



Instead of replacing the original light fixtures, the Sisters cleaned and updated the lights to use compact fluorescent bulbs, saving energy costs.

Three acres of constructed wetlands behind the Motherhouse filter wastewater from sinks and showers. In seven to ten days, this recycled graywater returns to the building to flush toilets.

References

Mission for the Millennium booklet and fact sheets (from IHM)

IHM website - www.ihmsisters.org

EPA. "How We Use Water In These United States" (www.epa.gov/water/you/chap1.html)

Interview with Sharon Venier, 1/26/2005

Interview with Sister Janet Ryan, IHM, 2/9/2005

Interview with Lynn Rogien, 2/21/2005

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Resources for further information

IHM Website - www.ihmsisters.org

This traditional-looking single family home demonstrates what is possible in terms of energy efficiency and the use of green building materials.

Project type	Residential
Project scale	Building
Construction type	New Construction - Greenfield
Date completed	May 2004
Address	4465 Burton Forest Ct, Grand Rapids MI
Subjects	Development Processes
	Materials Use
	Energy Efficiency
	Water Efficiency
	Cost Benefit Analysis
Building square footage	2,732 (3 Bed, 3 Bath)
Hard cost	$96 / sq. ft.

Grand Rapids, Michigan

Green Built Demonstration Home

History

For over 35 years, Lee Kitson has been building residential homes in Grand Rapids. In 2003 his company embarked on a project to highlight the benefits of energy efficiency and sustainable materials in residential settings. Kitson's energy efficient demonstration home maximizes the impact of cutting edge energy- and water-conservation technologies as well as environmentally sound materials.

Kitson used the environmentally sound products and services that were provided at promotional prices (see figure below for a comparison of hard costs with and without discounts). He then donated the project's proceeds to Green Built Inc, a non-profit organization that promotes sustainable buildings to the Greater Grand Rapids Home Builders Association. The home is part of a seven-acre development that consists of 15 sites, with homes ranging in size from 1,500 sq. ft. to 2,800 sq. ft., and sale prices from $240,000 to $395,000.

Many of the green enhancements came at little-to-no increase in construction costs, and simply relied on early material and design decisions. Some aspects, such as the basement wall construction and energy efficient windows, provide financial savings over the long run, but require a slightly longer time horizon to recover the premium paid. The environmental benefits of the green materials and equipment were also factored into decision making.

Construction Costs

Area	Square Ft	Cost w/o discounts	per sq. ft.	Cost w/ discounts	per sq. ft.
Main Floor	1,682	$235,500	$140.01	$221,500	$131.69
Lower Level	1,050	$26,500	$25.24	$26,500	$25.24
Total Hard Cost	2,732	$262,000	$95.90	$248,000	$90.78
Lot Cost		$65,000		$65,000	

Source: Lee Kitson Builders Inc.
Note: Costs do not include marketing and commissions, construction fees, overhead, closing costs, or indirect construction costs.

"Of the $10.00/sq. ft. premium paid, approximately $5.00 is added energy savings features and $5.00 is for ENERGY STAR appliances and other items which we would not include in standard home pricing."

- Lee Kitson

Development Processes

Developers' design decisions go a long way to protect the environment. For example, in the Demonstration Home project, builders only removed those trees on the property that stood where the structure or driveway would stand; leaving a wooded property that has a dedicated conservation easement from the rear of the building to the rear of the lot. Such decisions may not be entirely feasible on a heavily wooded properties, but builders can work to preserve the existing habitat by making important decisions about tree removal early on in the process.

Kitson avoided additional architectural costs for the project by basing the Demonstration Home plan on other homes he had built. Modifications to the plan included the addition of a retaining wall by the front porch so that a portion of the lower front was exposed to the south. Also, he opened the foyer dormer to the living area with a southern exposure, adding significant daylighting to the main living area.

Materials Use

The Demonstration Home structural framing used finger-jointed studs, manufactured with small pieces of wood and adhesive. The framing is truer, reduces site waste, and does not require lumber from large trees, helping to protect forests. Builders used similar products for floor joists, rim joists, and headers. Kitson employed a "raised heel" design for the roof trusses, allowing the insulation to extend over the exterior walls, and resulting in superior insulation along wall-to-roof joints. The sprayed foam product, Icynene, insulates the walls and ceiling; maintains its seal even with structural shrinkage; is water-based; and contains no CFCs, HCFCs, formaldehyde, or VOCs.

Reducing the use of virgin resources, builders used carpeting made from recycled PET (Poly Ethylene Terephthalate) manufactured from yarn produced from reclaimed 2-liter soda and other bottles. The floors in the kitchen, rear entry, and foyer were manufactured using cork harvested from living trees without harming the trees. Finally, the bathroom flooring is Marmorette linoleum by Armstrong, made from softwood powder, linseed oil, pine tree resins, cork, chalk, and jute backing, all of which are natural and renewable resources.

Outside, the home's deck was constructed with WeatherBest composite materials. WeatherBest products are manufactured with a composite of up to 50%+ wood fiber and thermoplastic polymers. The product's benefits, over using 100% wood-decking materials, include superior durability, fewer maintenance requirements, and decreased use of forest resources.

Water Efficiency

Kitson decided to install Caroma dual-flush toilets, which allow users to choose a small flush (0.8 gallons per flush) or a larger flush (1.6 gallons per flush) based on need. These toilets cost more than traditional toilets, but improved water efficiency covers the increased cost over the life of the toilet.

The dishwasher is an ASKO D3000 and uses less than four gallons of water (a typical dishwasher uses 7-10 gallons) and needs only 1 1/2 tablespoons of detergent per load. ASKO also manufactured the clothes washer and dryer, with an estimated annual utility (electricity and water) cost of $112 for the pair, compared to $360 for a traditional residential top-load washer and dryer or between $170 and $260 for comparable front load units.

By allowing the user to select a full (1.6 gallon) flush or a half (0.8 gallon) flush, this toilet reduces overall water consumption.

"This is a plan derived from others we have built. We did not have to make any expensive or radical changes to the typical design plan."

- Lee Kitson

This "on demand" system eliminates the need to keep an entire tank of water hot 24 hours a day, 7 days a week. Benefits include lower utility bills and a continuous supply of hot water.

Energy Efficiency

Builders constructed the Demonstration Home's foundation with a wall system by Great Lakes Superior Walls that uses pre-cast concrete, Styrofoam, and concrete studs. For additional insulation and air sealing, the foundation walls were sprayed with a bio-based foam insulation produced by Advanced Insulation Technology LLC. The insulation is soybean-oil based, water blown, and does not contain formaldehyde or emit CFCs or HCFCs, resulting in foundation walls with an insulation R-value of R-18.

The windows in the house are Pella Proline wood windows with aluminum exterior cladding. Meeting the highest ENERGY STAR rating, the windows contain insulated low-E glass. In addition to their superior insulation properties, Pella windows contain more than 20% recycled content.

Builders chose equipment for the HVAC system based primarily on improving energy efficiency. The Bryant Plus furnace is a two-stage, variable-speed unit with an efficiency rating of 96.6%. The Bryant thermostat allows the owner to control the unit's fan speed and to establish different temperature profiles for each day of the week. The Bryant SEER (seasonal energy efficiency rating) air-conditioning unit uses Puron, a chlorine-free refrigerant.

The entire HVAC system feeds through a Guardian Plus HEPA filter that filters particles as small as 0.3 microns. Finally, Kitson installed an UltimateAir Energy Recovery Ventilator. With an efficiency of 96%, the ventilator exchanges stale air with fresh filtered air while transferring heat and moisture between the two. The UltimateAir unit filters out 95% of pollens and optimizes lower outdoor air temperatures, reducing the load on the AC unit.

Water is heated using a Rinnai Tankless water heater that heats water as needed rather than heating a tank full of water 24 hours a day, seven days a week. The Rinnai unit easily heats water for the entire house and, saves as much as 50% on hot water heating bills. All the appliances installed in the house are ENERGY STAR rated with the exception of the dryer (ENERGY STAR does not rate dryers).

Estimated Annual Energy Cost*

Use	MMBtu	Cost	Percent of total
Heating	50.2	$323	28%
Cooling	3.4	$80	7%
Hot Water	18.2	$110	10%
Lights / Appliances		$469	41%
Service Charges		$150	13%
Total		$1,132 ($0.41 / sq. ft.)	100%

*Source: Energy Efficient Homes Midwest

biobased - *A commercial or industrial product that is composed of biological products or renewable domestic, agricultural, or forestry products.*

R-value - *A unit of thermal resistance used for comparing insulating values of different materials; the higher the r-value of a material, the greater its insulating properties.*

low-E glass - *Low-emissivity windows: glazing that has special coatings to permit most of the sun's light radiation to enter the building, but prevents heat radiation from passing through.*

Cost Benefit Analysis

The total cost premium associated with the efficiency and environmental "extras" for this house comes to $20,475, adding about $128/month to the owner's mortgage payments. According to Kitson, if builders installed only the products that deliver superior energy efficiency (96% furnace, advanced thermostat, extra insulation, water heater, Proline windows, and Superior Walls), the cost premium would be $8,580, adding about $53/month to mortgage payments. Kitson estimates that these investments alone would result in heating savings of $449/year, cooling savings of $120/year, and water heating savings of $54/year. These savings work out to $52/month, offsetting the increase in mortgage payments.

Installing all the extras (beyond just the energy efficient investments) listed in the table below would incur an additional premium of $11,895 ($20,475 - $8,580) above that paid for just the energy efficiency investments mentioned above. Additional savings include reduced electricity consumption from the fluorescent lights and ENERGY STAR appliances and water consumption savings from dual flush toilets, dishwasher, washer, and dryer. In fact, the washer and dryer alone would save more than $248/ yr over a traditional top load pair.

Other investments included in the additional premium may not indicate clear financial benefits, but would provide other benefits. Low-VOC paints and floor coverings provide a healthier indoor environment as does the HEPA filter. The composite materials used for decking offer improved durability and will outlast a deck made of traditional wood. The Energy Recovery Ventilator offers savings by reducing the load on the AC unit and it ensures a fresh air supply for the house.

Following guidelines established by the Home Energy Rating System Council (HERS), Energy Efficient Homes Midwest calculates that the Demonstration Home will significantly reduce emissions to 12,827 lb/yr of CO_2, 17 lb/yr of SO_2, and 22 lb/yr of NO_x. Currently, it is difficult to assign dollar values to these reductions; however, some environmentally conscious consumers understand that these reductions are important, assign their own values to them, and are prepared to pay the extra initial costs for the enhancements.

Cost Analysis

Item	Description	Cost Premium*
Appliances	ENERGY STAR dishwasher, washer, dryer, and refrigerator	$1,400
Lighting	Fluorescent fixtures and bulbs	$200
HVAC	High efficiency furnace, AC unit, thermostat, and HEPA filter	$3,590
Insulation	Icynene and bio-based insulations	$2,000
Landscaping	Preparation for rain garden installation	$1,500
Fireplace	Intellifire variable BTU fireplace	$400
Paints	Low-VOC paints	$600
Energy Recovery	Stirling Energy Recovery Ventilator (EVR)	$2,100
Wiring	Wiring for EVR, hot water thermostat, exhaust fans, etc...	$435
Plumbing	Caroma dual flush toilets and Rinnai tankless hot water heater	$1,050
Water softener	Braswell water softener	$2,000
Windows	Pella Proline Insulshield windows	$800
Deck and frame	Composite decking, TJI joists, finger joint studs	$900
Walling	Superior insulated concrete basement walls	$3,500
TOTAL		$20,475

**Represents the amount that Kitson estimates would be paid over typically installed equipment.*

Awards

- ENERGY STAR Rating: 5 Star Plus
- Energy Rating Points: 92.3
- Efficient Home Comparison: 61.5% Better

The Bottom Line

This Demonstration Home project is a clear example of the Green Development Spectrum described on page 16 of this handbook. Many of the investments in energy efficiency pay for themselves very quickly. However, other items, such as all-natural linoleum and energy-recovery ventilators create healthier living environments but the savings are less tangible and vary for each customer.

Energy efficient appliances and lighting as well as sustainable materials in the cabinets, surfaces and flooring all come together in a beautiful state of the art kitchen.

References

Interview: Lee Kitson (1/17/2005)

Energy Rating Report - 4465 Burton Forest Ct., Energy Efficient Homes Midwest

Green Built Demonstration Home - 4465 Burton Forest Ct., Lee Kitson Homes

Contact Information

Developer and Contractor	Lee Kitson Builder, Inc.: www.leekitsonbuilder.com
Lee Kitson	Owner, Lee Kitson Builder, Inc., (616) 363-6860, lee49341@aol.com

Resources for further information

Icynene Insulation System - www.icynene.com
WeatherBest Composite decking and railings - www.weatherbest.com
Great Lakes Superior Walls - www.greatlakessuperiorwalls.com
Pella Windows - www.pella.com
UltimateAir Energy Recovery Ventilators - www.ultimateair.com
Caroma Toilets - www.caromausa.com
Rinnai Tankless Water Heaters - www.foreverhotwater.com
ASKO Appliances - www.askousa.com
Armstrong Floorings - www.armstrong.com

Mick McGraw created Bailey's Grove with the goal of building a unique community that respected and integrated the natural surroundings within the development.

Project type	Residential
Project scale	Site
Construction type	New Construction - Greenfield
Date completed	Fall 2005
Address	2130 Enterprise SE, Kentwood, MI 49508
Subjects	Development Processes
	Site Planning
	Social Benefits
	Cost Benefit Analysis
Total project costs	Not provided
Total Acreage	364 acres

Kentwood, Michigan

Bailey's Grove

History

Bailey's Grove, a mixed-use community developed by Eastbrook Homes in Grand Rapids, is a 364-acre community of 1000 homes and condominiums, and 45 acres of wooded open space. The initial idea for the development began in the early 1990s, when local Grand Rapids developer and CEO of Eastbrook Homes Mick McGraw, and land planner David Jensen toured the undeveloped site, immediately recognizing the beauty of the natural surroundings. Their goal was to develop and build a unique community with modern amenities that respected and incorporated the natural surroundings.

"We made natural features marketing tools. And we're proving that using these concepts can help sell houses faster."

Mick McGraw

Development Processes

Bailey's Grove was created as a sustainable living environment that stressed community, human interaction, and a connection to the natural surrounding. Developer Mick McGraw wanted to build a village-like living environment where people from varying social and economic backgrounds could live and play together. According to McGraw, diversity is increasingly important when building residences and developments. With these goals, Bailey's Grove looks different from traditional greenfield developments. In place of the typical suburban design where suburban-style tract houses side-by-side dominate, Bailey's Grove incorporates greater green space, smaller streets, and more pedestrian-friendly walking paths.

Bailey's Grove is the only large-scale development of its kind in the state of Michigan. With the design and size of the development (364 acres), McGraw worked more closely with city officials, community leaders, and environmental organizations to get the development successfully built. Sharing the vision of the development with these groups was relatively easy for McGraw, but achieving approval for it was more challenging. One of the principle struggles was convincing city officials to allow for the construction of narrower streets throughout the development. Smaller streets give the development a more intimate feel, allow for more green space preservation, reduce the amount of impervious surface, and help reduce infrastructure costs.

First, McGraw gathered support and developed several "champions" among city officials who supported Bailey's Grove. Second, he developed trust with city officials, community organizations, and the environmental community who opposed elements of the development. He listened and addressed their concerns, and followed through on actions he promised them. And third, McGraw expressed his feelings about what he thought was important for the development. Throughout, he remained committed to his vision and goals and was steadfast in fighting for those elements he believed were crucial to the development.

Community and recreational activities are important to Bailey's Grove residents and have become a major selling point in attracting new customers and retaining existing residents.

On addressing urban sprawl: "The only population growth in Michigan is birth over death. People and development are not creating urban sprawl, mandated large-lot sizes are a principle cause of urban sprawl."

- Mick McGraw

Compared to traditional greenfield developments, Bailey's Grove incorporates proportionally more green space alongside smaller streets and more pedestrian-friendly sidewalks.

Site Planning

Site Planning and integrated design were crucial to Bailey's Grove. The development included over 350 acres, and McGraw found it most effective to work backwards from his ultimate vision of how the development would look and feel. The master plan relied heavily on natural environment inclusion, and McGraw and his development staff spent significant time throughout the entire development process walking the site and surveying the land and its natural features. According to McGraw, this sensitivity to the environment is an element often overlooked. "Developers worry too little about nature and too much about sewer and infrastructure issues," McGraw says. "Working with the land is as much art as it is science and, we developers must understand when enough is enough. It is important to understand the land and know how much it is willing to give."

As part of the preservation efforts, McGraw took a natural features inventory to determine what needed to be saved, with special attention paid to saving the existing trees on the site and moving those that would be in the way of houses elsewhere on the property. In total, 1,000 trees were uprooted and moved to other locations on the site. By preserving existing trees, McGraw not only saved money, but preserved the rural atmosphere that he wanted for Bailey's Grove. In fact, in 2003, Bailey's Grove won the prestigious "Building With Trees Award of Excellence", an award presented annually by the National Arbor Foundation to developers who employ environmentally friendly techniques to complement the natural surroundings.

Another important natural preservation goal was wetland protection. Originally, there were almost 10 significant wetlands on the property, all of which were integrated into the overall design. In addition, the development team designed a massive wetland on the property to attract birds and create species habitat. In the process, McGraw discovered that to preserve and maintain the wetlands, there must be a constant source of water as well as constant care and attention to the wetlands' preservation. The wetlands act as a natural stormwater system and their integration into the development assists in the overall goal of natural preservation.

On working with environmentalists and preservationists: "We are often more aligned with their (environmentalists) thoughts. We have developed an understanding of what we're both trying to do. At the end of the day I think those in the development community have a great desire not to use any more land than we have to."

- Mick McGraw

Social Benefits

Bailey's Grove was designed to accommodate people with a range of economic backgrounds and lifestyles. Homes range from single apartment units to large 4-5 bedroom single-family homes, and are not segmented by type within the development. The different units complement and mesh with one another within the development. This distinct diversity that Bailey's Grove creates is usually found only in urban areas; McGraw managed to create such diversity in a suburban environment.

Bailey's Grove adapts to people's changing lifestyle needs and is responsive to the changing housing demands of its residents. McGraw is building long-term relationships with his customers and reports that Bailey's Grove residents who must move due to changing family needs are moving to new homes within the development rather than outside of Bailey's Grove. "A family could move three or four times over several decades, yet could remain in Bailey's Grove for the entire time," says McGraw. From a sales and marketing perspective, this benefit attracts and retains homebuyers and owners. The very elements that attracted customers to Bailey's Grove are the same elements that are keeping them.

Cost Benefit Analysis

McGraw believes in two methods for residential development: (1) traditional use of available land so that each homeowner owns a spacious lot, and (2), McGraw's preferred way, condensed individual lots to incorporate community open space into the overall development. McGraw says that "Builders confined to two-acre lot sizes are frustrated because fixed-lot sizes cost more money in infrastructure and other costs, and they eat up valuable land."

Bailey's Grove is an example of cluster development designed to have an average of 4 units per acre. McGraw placed more homes on less land to save on land acquisition and infrastructure costs.

Used	Homes per acre	Total Number of Units	Total Acreage Used
Traditional Development	2.5 residential units	1,638 units	655 acres
Bailey's Grove	4.5 residential units	1,638 units	364 acres

A planned community can consume about 45% less land, cost 25% less for roads, 15% less for utilities and 5% less for housing (Watershed Protection Techniques).

Awards

- National Arbor Day Foundation, Building With Trees, 2003
- 2003 Conservationalist of the Year, Issac Walton League of America
- Deemed partner in water quality preservation efforts by MDEQ, 1997
- Acknowledged by the Grand Valley Metro Council for injecting community-stabilizing principles into the Bailey's Grove plan, 2000

The Bottom Line

Innovative new development projects like Bailey's Grove face the same challenges that traditional projects face, in that community input, city approval, and continued commitment to a goal are all essential elements. Mick McGraw worked through these challenges to create a development that respects and preserves the natural environment.

Environmental preservation is often viewed as a hindrance to development, whether it is in an urban, suburban, or rural setting. The Bailey's Grove development proves that environmental preservation and sensitivity can coexist with development. Furthermore, not only are they not mutually exclusive, but integrating components of nature and conservation as a marketing tool helps sell homes and retain customers.

Bailey's Grove was designed to have an average of 4.5 units per acre. Traditional development typically has 2.5 units per acre.

References

"Eastbrook Homes' McGraw Lands on Land-Use Council," David Cruzak, Grand Rapids Business Journal, March 3, 2005

"Builders and Developers Honored for Tree Conservation Efforts," National Association of Home Builders, Land Development. Volume 16, Number 4, Fall 2003

Interview with Kristy Harrington (Eastbrook Homes)

Interview with Mick McGraw (Eastbrook Homes)

Contact Information

Developer	Mick McGraw CEO, Eastbrook Homes, (616) 455-0200
Land Planner	David Jensen, David Jensen Associates, Inc. (303) 369-7369
Engineer	Medema VanKooten, Dale VanKooten, (616) 451-0639

Resources for further information

www.eastbrookhomes.com

www.arborday.org/programs/BuildingwithTrees/ (Building with Trees Award)







institutional

With its solar orientation, open floor plan, large exterior windows, and chimney-like structures in the roof, the building's design captures the maximum amount of natural sunlight to provide a dynamic and pleasurable atmosphere for learning.

Project type	Institutional
Project scale	Building and Site
Construction type	New Construction - Urban Infill
Date completed	January 2004
Address	3090 East Eisenhower Parkway, Ann Arbor, MI 48108
Subjects	Energy Efficiency
	Stormwater Management
	Materials Used
	Social Benefits
	Development Processes
	Lessons Learned
	Funding Sources
Total project costs	$4.38 Million
Building square footage	14,000 sq. ft.
Cost / square foot	$462 / sq. ft.

Ann Arbor, Michigan

Malletts Creek Branch

of the Ann Arbor District Library

History

The Malletts Creek branch of the Ann Arbor District Library was built to replace the existing 4,500-square-foot Loving Branch and to further the mission of the Library. The Library selected the local architecture firm, Luckenbach Ziegelman Architects, PLLC, to begin site designs. Early in the process, the firm discovered that Malletts Creek flowed directly through the site in an underground pipe below the surface. Almost immediately, the Library began to assess its options for sustainable site development.

With the assistance of the local watershed advocacy group, Malletts Creek Association, and the project's landscape architecture firm, InSite Design Studio, Inc., the Library's Board of Trustees reviewed the implications and opportunities that the building site possessed. Board President J.D. Lindeberg, an environmental engineer, teamed up with Josie Barnes Parker, the director of the Library, to convince the Board of Trustees to expand the notion of sustainable site development to include the building. This approach would allow the Library to exhibit and showcase the benefits of sustainable development in a highly visible public institution.

Convincing the Board of the benefits of sustainable development involved preparing life-cycle cost analyses (based on a 40-year life cycle) and annual energy- and HVAC-savings projections, as well as discussing public perception and education opportunities. The Library's decision to move forward with a sustainable design approach was due in part to the new building's tremendous energy savings, reducing the long-term cost of the building.

life-cycle cost analyses - *An objective assessment of the cost of a design feature that allows for production, sales, operation, maintenance, and demolition or recycling costs. The cost also encompasses all the environmental burdens of the product or process through its entire service life.*

Energy Efficiency

The building utilizes several energy efficiency techniques and technologies, ranging from simple methods to calibrated systems-monitoring devices. Principally, the building design capitalizes on its solar orientation for both solar heating and use of natural light. Several techniques fully capture these natural benefits; for example, dark-stained concrete floors in key areas capture heat from the winter sun to contribute to the building's thermal mass. To counter the intense heat from the summer sun and minimize traditional AC-unit reliance, motorized awnings and sunshades extend to shade the building's interior. Also, light level sensors minimize the use of artificial light when outside sunlight is at sufficient reading levels.

The building also utilizes convection cooling with its four large chimney-like roof structures, as seen in the building photograph below. These structures conduct the circulation of natural air into the operable windows, through the building, and out the top of the chimneys. This method of ventilation reduces the use of forced-air circulation systems and meets indoor air quality requirements. In winter when the chimneys are closed, monitor fans located inside the chimneys re-circulate trapped heat.

The building's heating system is a circulating hot-water radiant system in the flooring units. This highly efficient system produces consistent warmth for the entire building and eliminates the noise from a traditional forced-air system.

The vegetated green roof contributes to thermal mass, insulating the building from extreme temperatures, thereby reducing the load on heating and cooling units. The R-value of a conventional roof is R-19; the Malletts Creek Library green roof has an R-value of R-30.

The Malletts Creek Branch of the Ann Arbor District Library features several green technologies both inside and out; a green roof, bioswales in the parking lot, solar panels, and recycled materials.

convection cooling - *The transfer of heat via a fluid motion (typically air). In distributed power systems, this is accomplished by the movement of air over the module or heatsink surface.*

green roof - *A roof of a building which is partially or completely covered with plants. It may be a tended roof garden or a more self-maintaining system. Green roofs increase roof life span, reduce stormwater runoff, reduce the urban heat island effect, and provide amenity space for building users.*

R-value - *A unit of thermal resistance used for comparing insulating values of different materials; the higher the r-value of a material, the greater its insulating properties.*

The sediment trap in the bioswales capture sediment and pollutants from the parking lot runoff, protecting the habitats and water quality of Malletts Creek and further downstream.

Stormwater Management

Recently, Washtenaw County passed new, more stringent watershed guidelines. These new guidelines mandate that new development must be responsible for 100% of the stormwater that falls onto the site, i.e. capturing, storing, and cleaning the storm-water before being slowly discharged into conventional storm sewer systems, and ultimately into the Huron River. The position of the Library's site directly above Malletts Creek increases the importance of handling stormwater responsibly. The Library selected the landscape architecture firm, InSite Design Studio, Inc, precisely because of its experience and technical knowledge solving similar challenging stormwater problems.

InSite Design's plan for the 2.66 acre site utilizes a variety of stormwater management methods. These include careful site grading, a vegetated swale, bioswales within the parking lot, and a vegetated green roof. The grading of the site allows the stormwater to travel the longest possible distance on the surface of the site along a vegetated swale before it enters the detention area. This swale provides the greatest opportunity for the stormwater to evaporate, infiltrate, or be taken up by the native plants, and reduces the amount of stormwater that enters the detention area. This long travel path for the water allows for the reduced size of the detention pond.

The bioswales within the parking lot utilize a highly engineered system for collecting stormwater from the parking lot and dealing with the sediments and pollutants that parking lot runoff carries with it.

The bioswales at the Malletts Creek site are designed to capture a maximum of 6" of stormwater runoff, which handles the first flush of most storm events. This first flush is the stormwater that falls at the beginning of a storm event and contains the most polluted water that flows into conventional systems. By capturing and cleaning this water, this system controls much of the overall water quality of stormwater that is discharged into Malletts Creek.

In addition to adding to the building's thermal mass, the vegetated green roof contributes significantly to stormwater absorption. With its eight varieties of sedum plants and 3.5" of growing medium, the green roof reduces stormwater runoff by as much as 50% with zero runoff in light rain. Plus, the roof water that does reach the ground is directed into the vegetated swale and becomes part of the larger stormwater system.

By using native vegetation and a grading plan, the parking lot design and landscape plan:

- reduce impervious surface
- eliminate the need for irrigation
- allow for trench footings for building construction
- reduce landscape maintenance

bioswales - *A depression in the land designed to capture and infiltrate stormwater by utilizing appropriate vegetation planted on the bottom and side slopes.*

first flush - *The condition, often occurring in storm sewer discharges, in which a disproportionately high pollutional load is carried to the first portion of the discharge or overflow.*

Sustainable and Recycled Materials in the Malletts Creek Branch Library

- Cork flooring
- Woven carpet
- Stained concrete
- Butcher block table and shelving tops
- Certified wood beam structural frame
- 50% recycled-content gyp board
- Copper cladding
- Masonry units

Materials Use

At every level, materials for the construction of the Library were carefully selected not only for their durability, aesthetics, and cost effectiveness, but for their sustainability. Luckenbach Ziegelman Architects researched the materials' recycled content, energy consumption for manufacturing and transport, recyclability, and the extent to which they would become renewable resources. Other considerations for materials included sound-proofing and acoustic quality, light-reflecting ability, and maintenance requirements.

Social Benefits

The Malletts Creek Branch Library capitalizes on its role as a community amenity by showcasing the application of sustainable building principles in a publicly accessible location. Public education about sustainable development begins before the visitor even enters the Library, with interpretive signage located outside the building explaining the stormwater management techniques within the parking lot and on top of the building. Inside the building, the open floor plan and exposed structural elements allow visitors to view aspects of the building construction, such as roof joist construction and electrical conduits. The Library is developing educational signage for the interior of the building to highlight the sustainable materials, energy conserving technologies, and the building's use of sunlight and precipitation that it plans to display in the fall of 2005.

Development Processes

During the construction process, great care was taken to maximize the diversion of waste materials from landfills by collecting materials that could be reused or recycled. Construction supervisors for the building project, Skanska USA Building, Inc., sorted waste materials into various piles such as cardboard, wood, metal, drywall, and concrete. Subcontractors were responsible for their own waste products, providing further incentive to recycle materials. By encouraging recycling of waste materials, 60% of all waste products generated from construction were successfully diverted from landfills.

Skanska also was committed to preserving water quality during the construction process. By first grading the bioswales and permanent site contours, all the stormwater was absorbed on site during the entire construction process, thereby protecting Malletts Creek from sedimentation, erosion, and pollution.

Lessons Learned

Turning the concept of a sustainable library into a reality was a learning process for all parties involved. Integrating new concepts of sustainability while working through the usual complications of working in sync with builder, subcontractors, architects, landscape architects, client, and the public proved challenging, but well worth the effort.

Funding Sources

The Library received a grant from the EPA for $236,000 to finance the vegetated green roof and water-quality monitoring in the bioswales. The water-quality monitoring program focuses on chemical analysis of the stormwater that travels from the bioswales into the detention pond, before flowing into Malletts Creek. In addition the Library raised $144,750 in matched funding to contribute to the building fund.

The Bottom Line

Education for everyone involved proved to be crucial to the success of the project. Early in the process, board members of the Library needed to learn to look beyond the higher upfront costs to realize the sustained energy savings for the life of the building. During the process, both the architect and landscape architect learned the value of allowing flexibility in scheduling and material choices. Upon completion of the project, all parties involved agreed that the key to the success of this project was the unwavering commitment of the Library to create a sustainable building that would serve not only the needs of the Library and its community, but the needs of the environment, creating a lasting example that will guide future generations to sustainable solutions for development needs.

The library features several sustainable building materials, such as cork flooring and energy efficient lighting.

References

Ann Arbor District Library. Malletts Creek Branch Floor Plan. Ann Arbor, MI: Ann Arbor District Library, 2004

Michigan Department of Environmental Quality. Ann Arbor District Library: Innovative Storm Water System. Lansing, MI: 2004

PowerPoint Presentation: http://production.aadl.org/malletts/LZA_malletts.ppt

CAM Magazine Article: Malletts Creek Branch Library - A New Chapter in Green Building by Mary E. Kremposky Fall 2004 pp. 44-54

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Resources for further information

http://www.aadl.org/stories/storyReader$3003

http://www.deq.state.mi.us/documents/deq-ess-nps-ann-arbor-district-library-factsheet.pdf

http://www.skanska.com/skanska/templates/page.asp?id=5592


DEQ
MICHIGAN
DEPARTMENT OF ENVIRONMENTAL QUALITY

Project type	Institutional
Project scale	Building & Site
Construction type	New Construction - Urban Infill
Date completed	January 2005
Address	27700 Donald Court, Warren, MI
Subjects	Energy Efficiency
	Materials
	Water Efficiency
	Development Processes
Total project costs	Not provided
Building square footage	68,150 sq. ft.; 35,926 sq. ft. occupied by MDEQ

Warren, Michigan

DEQ Southeast Michigan District Office

History

Since 1989, the Southeast Michigan District Office of the DEQ has been located in an office park in Livonia. When its lease expired, the agency–which serves St. Clair, Macomb, Oakland, and Wayne counties–began thinking about relocating to a more central location. The agency was also aware that it needed to "practice what it preaches" through sustainable development practices to build the first *green* state office building.

The current site for the District Office in Warren was formerly the site of the Warren Army Tank Plant grounds. In operation from 1941 to 1996 and the production site of Sherman tanks for World War II, the site's residual contamination qualified the land as a brownfield. The contamination on the land had been cleaned up to meet development codes and standards, and the agency wanted to set an example for other state agencies and private organizations and saw this site as a prime opportunity to live by their own environmental standards.

The DEQ also chose to develop on the Warren Tank Plant site because of lower leasing costs and the centralized location in Warren. The DEQ pre-signed the lease with ProVisions LLC and hired a local architecture firm and contracting company to develop plans for the sustainable building. The new DEQ office is located within an office and manufacturing development on Van Dyke Avenue.

The Warren DEQ building utilizes green building techniques to conserve energy, reduce fossil fuel emissions, and use recyclable materials. These sustainable techniques range from simple actions with small commitments to complex actions with larger commitments. (See page 16 to view the green development spectrum.)

brownfield - *Abandoned, idled, or under-used industrial and commercial facilities/sites where expansion or redevelopment is complicated by real or perceived environmental contamination.*

Energy Efficiency

The simple actions the DEQ building utilizes include the use of natural daylighting and lighting fixtures that use zoned automatic sensors and timers. The open floor plan of the building with its minimal floor-to-ceiling partitions utilizes sunlight that penetrates the large windows on the exterior of the building. Other simple techniques for energy efficiency include automated controls for the HVAC systems and a tankless water heater that heats water only on demand, rather than continually, thereby saving energy.

"By using wind power to help supply electricity to the building, more than 1 million pounds of CO2 will be eliminated from the atmosphere over a two-year period."

- Kevin King, office space administrator for the DEQ.

A unique feature of the building is its white membrane-covered roof. The reflective nature of the white roof minimizes the need for air-conditioning on hot summer days by reflecting rather than absorbing the heat of sunlight. Although this feature cannot be easily seen by visitors and employees, the reduced energy bills are hard to ignore.

Examples of more complex energy efficient techniques used by the DEQ include the purchasing of green wind power and the use of hybrid fleet vehicles. Although sustainable energy sources such as wind power are not widely available yet in the state of Michigan, the DEQ has purchased wind power from utility companies in other regions of the country while still utilizing electricity through the existing power grid. The purchased wind power is then traded in for vouchers to use traditional energy without increasing the demand for traditional energy. By using clean energy sources the DEQ is promoting the use of sustainable energy sources rather than energy sources that consume fossil fuels.

The DEQ is participating in the testing and use of hybrid gasoline-electric motor vehicles in its roughly 30-vehicle fleet. Several of these vehicles are ethanol-85 capable, and a few of the vehicles are gas-electric.

Although the uninformed visitor will not detect most of the energy efficient technologies utilized by the DEQ building, the DEQ has already begun to see reduced energy usage and savings benefits. In total the DEQ expects to reduce their overall energy usage by 35%.

The rolling file system requires less space than a traditional filing system consuming less interior square footage.

white roof - *White roof, or 'cool roofs,' help to better reflect solar energy and thus radiate away absorbed heat. White roof applications have a smooth, bright white surface to reflect solar radiation, reduce heat transfer to the interior, and save on summertime air conditioning.*

The large exterior windows allow more natural daylighting, improve the work environment inside, and lower electicity usage.

Materials Use

All of the materials used in the construction of the new DEQ building have a sustainable component to them - whether from a local source or containing recycled content or materials. A tremendous effort was made to ensure a sustainable source for building materials. All materials were shipped from sources less than 500 miles away, reducing fossil fuel emissions and supporting the local economy.

Perhaps the most impressive materials-feat the DEQ performed that exemplifies their commitment to the environment is their reuse of office cubicle dividers and conference room seating. Old cubicle dividers where dismantled, cleaned, repainted, and reupholstered to provide new office spaces in the current building. In addition to diverting waste from a landfill, this process produced a savings of $717,000 - a considerable amount for the state-funded agency. Conference room chairs were also rebuilt, saving the DEQ $130 per chair.

The interior of the building was finished with low-VOC paints and adhesives to improve the indoor air quality for employees. Also, separate bins are located throughout the building for recycling several materials including white paper, newsprint, corrugated cardboard, batteries, and non-food polystyrene.

Water Efficiency

Water efficiency was a top priority in the design and development of the building, not only for environmental reasons but also for cost saving purposes. The technologies utilized inside the DEQ building reduce overall potable water usage by 20% and utilize stormwater for irrigation on the outside of the building.

Building technologies include motion-sensor controlled water faucets, waterless urinals, and air-assisted dual-flush toilets in the restrooms. These water-efficient technologies made for an interesting and educational transition for employees from the old office into the new office. A source of many laughs in the first few weeks of occupancy, the effectiveness of the technologies was soon taken seriously when evidence of lower water usage became apparent.

Outside the building, stormwater is collected from the roof and parking lot and stored in an underground stormwater retention vault. Some of this stormwater is utilized for irrigating the native landscape plants, which are adapted to hot, dry Michigan summers and therefore require less irrigation and maintenance. Using this stormwater for irrigation reduces the need for potable water and saves the DEQ money in reduced water bills.

The white roof minimizes the need for air conditioning by reflecting rather than absorbing the heat from sunlight.

VOC - *Volatile organic compounds; Secondary petrochemicals which evaporate readily into the atmosphere at normal temperatures. They include light alcohols, acetone, trichloroethylene, perchloroethylene, dichloroethylene, benzene, vinyl chloride, tolulene, and methyl chloride. These potentially toxic chemicals are used as solvents, degreasers, paint thinners, adhesives, and fuels and contribute significantly to photochemical smog production and certain health problems. Signs and symptoms of VOC exposure may include eye and upper respiratory irritation, nasal congestion, headache, and dizziness.*

Development Processes

Because the site is located on a brownfield, restrictions have been placed on the type of use of the site. Office space for the DEQ fit the use requirements and the previous landowner had already cleaned up most of the site, making the site an ideal site for the new District Office.

In addition to the benefits of the site qualifying as a brownfield, its location along Van Dyke Avenue also meant access to existing utilities and infrastructure. By developing on previously-developed land, known as urban infill development, the project required minimal development costs, as opposed to suburban or greenfield development. These reduced development costs allowed the DEQ to direct funds to other sustainable infrastructure uses, such as the installation of the underground stormwater retention vault. This buried concrete vault stores collected stormwater for irrigation and slow release into the storm sewer system, thereby reducing the effects of first flush on urban waterways and downstream ecosystems.

Awards

- Currently applying for LEED Silver Rating

Extra office space controlled by energy-saving light fixtures on sensors allow for flexiblity as the needs of the buildings' occupants change.

first flush - *The condition, often occurring in storm sewer discharges, in which a disproportionately high pollutional load is carried to the first portion of the discharge or overflow.*

"The new Southeast Michigan District Office is a demonstration of the DEQ's commitment to being a leader in promoting environmentally sound business practices. I hope that we see many more of these green buildings being constructed not only by the state, but by private companies across Michigan."
- Steven E. Chester, DEQ Director

The Bottom Line

The new DEQ building is successful in utilizing several green technologies - from simple to complex - to conserve the precious resources of energy, water, money, and the environment while living up to their own standards of environmental protection and stewardship. Because of the success and influence of the Warren DEQ building, the state plans to build an even more environmentally-friendly office building in Bay City in the next 18 months to two years, according to Kevin King, office space administrator for the DEQ. "The new Southeast Michigan District Office is a demonstration of the DEQ's commitment to being a leader in promoting environmentally sound business practices. I hope that we see many more of these green buildings being constructed not only by the state, but by private companies across Michigan" says Steven E. Chester, DEQ Director.

The DEQ took extra steps to recycle office furniture by dismantling, repainting, and reupholstering the cubicle dividers and office chairs.

References

The Detroit News article by Gene Schabath: Michigan Saves By Going Green, March 16, 2005

DEQ Press Release: DEQ Moves in to New Warren Office, March 1, 2005, revised by Pat Watson

Interview with Edward Girodat, ProVisions LLC

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Resources for further information

www.michigan.gov/deq

Urban Catalyst Associates

Urban Catalyst Associates

Urban Catalyst Associates (UCA) is an interdisciplinary team of recent University of Michigan graduate students who have combined their experiences, interests, and educations to create a positive impact on the future of the State of Michigan. The team holds a strong passion for fostering innovative, sustainable development that will shape the evolution of the new urban environment.

In collaboration with the Michigan Department of Environmental Quality, Urban Catalyst Associates developed this handbook to serve as inspiration and ready reference to the development community and other interested groups. As the State furthers its investment in green development, the UCA team hopes that this handbook will encourage developers to infuse elements of environmental sustainability into their planning and development processes.

Urban Catalyst Associates can be contacted via email at uca@uca-michigan.com. See the contact information below for information on contacting individual team members.

Zeb Acuff

Zeb holds Master's degrees from the School of Natural Resources and Environment and the Taubman College of Architecture and Urban Planning, both at the University of Michigan in Ann Arbor. He is also a 2001 graduate of the College of Agriculture and Natural Resources at the University of Delaware. Zeb has extensive experience in farmland preservation and local planning research, as well as familiarity working with demographic and social science media. His professional interests include parks and recreation planning, non-motorized transportation, trails and greenway development, and public transit systems. Zeb and his wife currently reside in Dexter, Michigan. Zeb can be contacted via email at zeb@theacuffs.com.

Bryan Magnus

Bryan graduated from the University of Michigan in April, 2005, with an MBA from the Ross School of Business and a MS from the School of Natural Resources. His undergraduate degree is in Finance and Actuarial Math from Bryant University in Smithfield, Rhode Island. Bryan has extensive knowledge of socially and environmentally responsible business with an emphasis on renewable energy and alternative transportation. He has interned with General Motors' Fuel Cell Activities Group as well as Honeywell's Transportation Systems, and is currently employed by Honeywell TS as a Marketing Analyst. Bryan, his wife Lynn, and their "child" Meadow (dog) live in Ann Arbor, Michigan. Bryan can be contacted via email at magnusb@umich.edu.

Aaron Harris

Aaron will complete his final year at the University of Michigan in spring 2006 with both an MBA from the Ross School of Business and an MS from the School of Natural Resources and Environment. Prior to Michigan, Aaron co-founded Harris Brothers LLC, a real estate development/management company based in Chicago and focused on green building design and environmentally sensitive renovation projects. Upon completion of graduate studies, Aaron plans to return to the real estate field to pursue urban brownfield redevelopment projects. Aaron graduated from the University of Wisconsin-Madison with a BA in Sociology (Honors) and a Certificate in Environmental Studies. Aaron can be contacted via email at aaronmh@umich.edu.

Allyson Pumphrey

Allyson graduated from the School of Natural Resources & Environment with a Master's degree in Landscape Architecture in April 2005. Prior to attending the University of Michigan, she received her BS in Landscape Horticulture & Design from Purdue University in West Lafayette, Indiana. Allyson has experience in residential site design and urban redevelopment projects. Her professional interests include urban trails and greenways, brownfield redevelopment, and urban design. Allyson is employed by InSite Design Studio, Inc. in Ann Arbor, Michigan. Allyson can be contacted via email at apumphrey@insite-studio.com.

Larissa Larsen

Larissa Larsen, Ph.D., is an assistant professor with positions in both the School of Natural Resources and Environment and the Urban Planning Program at the University of Michigan. Larissa has a Master's in Landscape Architecture degree from the University of Guelph in Canada and a Ph.D. in regional planning from the University of Illinois at Urbana-Champaign. Prior to becoming a professor, Larissa practiced landscape architecture and urban planning in Chicago. Her current research investigates the ecological and social impacts of urban settlement patterns. Larissa can be contacted via email at larissal@umich.edu.

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Urban Catalyst Associates

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