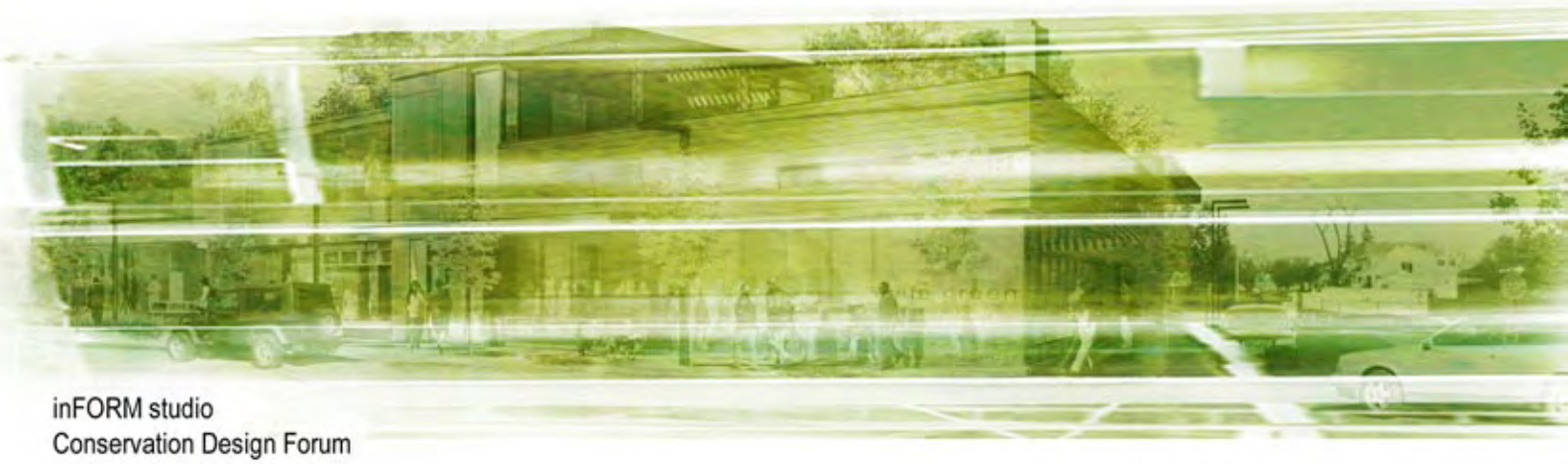
Schematic Design Package;

Detroit Sustainability Center

Detroiters Working For Environmental Justice
Southeast Michigan Sustainable Business Forum

10123 Grand River Avenue East
Detroit, Michigan

December, 2010



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Project Overview

The Detroit Sustainability Center
Vision

Detroiters Working for Environmental Justice (DWEJ) was formed for the express purpose of addressing the disproportionate burdens faced by people of color and low-income residents in environmentally distressed communities.
The ***Build Up Detroit*** (BUD) Program of Detroiters Working for Environmental Justice is dedicated to transforming Detroit into a national leader in sustainability through a comprehensive strategy of:

- green job creation and training,
- civic engagement, and
- community and economic development.

BUD's vision moves sustainable development beyond green building to empower communities to take leadership in transforming their environments into healthy places in which to live, work, and play. BUD's work, which includes its green jobs training program, is therefore as much about reclaiming lives as reclaiming the environment.

DWEJ and the Southeast Michigan Sustainable Business Forum (SMSBF) have partnered to develop the Detroit Sustainability Center (DSC). The DSC envisions the resurgence of Detroit as a vibrant urban center where all can thrive in environmental, economic and social health. The heart, pride and creativity of Detroit are the roots and catalyst for local and regional change.

Working with nonprofit business and governmental agencies, the DSC will serve as an engine for ecological, economic and social change toward a sustainable society. The center will operate as a 'living system' to explore the ways in which people design and construct sustainable buildings which in turn contribute to the general health and well being of its inhabitants and neighbors.

The **DSC** will accelerate the principles of green design, becoming a sustainable catalyst to the region, expanding the image of Detroit as a viable sustainable green economy and providing a new model for urban redevelopment. By empowering the local communities and encouraging people to take leadership in transforming their own environments into healthy places to live, work and play, the **DSC** aims to enhance the quality of life for residents and workers in the City of Detroit. The Center will serve as a community and professional resource hub, highlighting and expanding on the knowledge base and contemporary practices of sustainable design and lifestyle in the city of Detroit and beyond.

It will foster this new economy through the incorporation of civic engagements, job training, green business incubation, green construction, and policy innovation, striving to increase public and private collaboration in order to achieve a more comprehensive and efficient approach to promote healthier buildings and communities.

Mission:

The mission of the Detroit Sustainability Center is to achieve a just and vibrant green economy by working with nonprofit, business, and governmental entities to:

- coordinate ongoing sustainability efforts,
- build community capacity to expand the impact of these efforts,
- cultivate new enterprise to fill gaps in service and education so that all Detroit's residents will be able to take advantage of the opportunities offered by the new green economy.

Objectives:

- Increase public and private collaboration to bring a comprehensive and efficient approach to promote greener, healthier buildings and communities.
- Enhance quality of life for the residents and workers in Detroit and surrounding communities.
- Expand the image of Detroit as a model of an equitable, sustainable green economy.
- Establish credible green policies and programs across the city and region through innovative public-private collaboration.

The Detroit Sustainability Center will provide:

- State-certified job training in emerging green industries and brownfield remediation for displaced, unemployed, and underemployed workers
- Resources for developers regarding green building techniques and financing tools for sustainable development
- A center for organizing and youth leadership in environmental stewardship
- A green cafe serving locally grown food
- A coordinating center for policy around sustainability issues
- An incubator for startup businesses pursuing environmentally sustainable practices
- Technical assistance to businesses that desire to reduce its carbon footprint by incorporating pollution prevention mechanisms and/or employing best practices in their relevant industries that will do the same
- A sustainable solutions lab for public education, hands-on training and demonstrations
- A LEED destination site with public access from that will model Detroit's unique opportunities for sustainable adaptive reuse of existing structures.

Site | Facility Goals:

Identify a facility within the City of Detroit primed for adaptive reuse, which will serve as the physical home of the Sustainability Center, and convert it into a high-level LEED certified green building with the following criteria:

- Urban location – Adaptive Reuse of an existing building.
- Easy access by multiple-modes of transportation including walking and biking
- Highest example of environmentally sensitive renovation
- Use of alternative/renewable energy sources to minimize carbon footprint
- Interior build-out planned to optimize training, job creation and collaborative success
- Zero stormwater runoff site and native/adaptive plantings
- Maximum use of locally manufactured green building products and services.
- Provide exceptional facilities and structures through architectural preservation, green principled design, and an appropriate site aesthetic.
- Enhance cultural restoration and connections by understanding the past as a way to secure the future.
- Restore site ecosystem functions by creating and promoting a land ethic, and supporting long-term stewardship of a site's natural assets.
- The establishment of a courtyard and green space for community interaction. Maximize sustainable contributions to the local community
- Provide programming for external use of space by building occupants and the neighboring community – such as community garden etc.
- Orient public aspects of the building to Prairie and Grand River
- Use tools such as the Integrated Environment Systems to model energy impact of the building.
- Design DSC for long term use and durability – but maintain considerations for disassembly (i.e. – bolted connections)
- Design the DSC to be flexible and adaptable to future program uses, and for service and communications updating.
- Ensure share spaces are flexible, allowing for a variety of uses
- Explore opportunities to recover waste materials into new building materials

- Explore opportunities to use "rediscovered" supplies of wood such as wood damaged locally by the Emerald Ash Borer.
- Design the building to accommodate movement of occupants, encouraging interaction and socialization between building occupants.
- Create a variety of spaces for interaction of building occupants.
- Track and monitor the number of jobs created as a result of the creation of the DSC project.
- Promote and encourage community use of the facility.

Partnership:

One of the primary parters of the DWEJ is the Straight Gate International Church, the property owner of the site proposed for the Detroit Sustainability Center, which has served the city of Detroit since 1978. Its mission, in part, is to make the families of Detroit whole and in doing so, meet the spiritual, physical and mental needs of the people they serve. The Straight Gate International Church is commited to the surrounding neighborhood, striving to address the housing needs of senior citizens, provide opportunities to youth and serve the community through business development.

As DWEJ's partner in the Detroit Sustainability Center, the Southeast Michigan Sustainable Business Forum (SMSBF) will provide sustainable development technical skills to plan for a state-of-the-art sustainable designed building which exhibits the highest level of achievement in materials and technology. Through the SMSBF, the business community will have an opportunity to help shape the development of the business priorities of the Center while providing for an Education-based Program that Connects All Ages to Job Training and Nature

- Establish as the icon for green advances and improvements in the City of Detroit and surrounding communities and a new home for the environmental worker training program.
- Create engaging, relevant programs for students and visitors:
  - Develop a series of green technology programs based on traditional work ethics, and sustainable principles to include interactive hands-on experiences.
  - Provide interpretation and demonstration of high performance buildings, land stewardship practices and lessons in local ecology.
  - Create a setting that could support a nature-based school.

Organizations:

Detroiters Working for Environmental Justice is committed to empower individuals, communities, and community organizations in Southeast Michigan to educate, advocate and organize for cleaner, healthier communities and environments.

The Southeast Michigan Sustainable Business Forum's purpose is to enable business leaders in Southeast Michigan to create long-term and sustainable value for stakeholders in a region and world undergoing fundamental and rapid economic, environmental, and social change.

Guiding Principles of the Detroit Sustainability Center

The Guiding Principles are overarching, interrelated statements regarding the essential qualities of the Detroit Sustainability Center with which all involved groups agree:

- Offer individuals, communities, and local organizations opportunities to educate, advocate and organize for cleaner, healthier communities and environments with a strong emphasis placed on community cultural, social and environmental experiences and diverse cultural perspectives.

- Serve as an engine for ecological, economic and social change toward a sustainable society. The center will operate as a 'living system' to explore the ways in which people design and construct sustainable buildings, communities and spaces which in turn contribute to the general health and well being of its inhabitants and neighbors, furthering the understanding of responsible land use and renewable resources in the interest of a sustainable planet for all living things.

- Development of community-driven policymaking designed to disseminate information about personal and consumer choices to preserve natural resources and produce as little waste as possible while making the conscious decision to challenge and re-prioritize our lifestyles to ensure the health of the natural world for present and future generations.

- Affirm the need for urban and rural ecological policies to clean up and rebuild our cities and rural areas in balance with nature, honoring the cultural integrity of all our communities and providing fair access to the full range of resources for all. Honoring the cultural and natural heritage of a site ensures its sustainability, beauty and a feeling of pride and a sense of place.

- Education, authentic experience, and dedicated work are the foundation of physical, mental, and spiritual health and well-being. The center affirms the right of all individuals to a safe and healthy work environment; researching urban problems to build a knowledgebase which will change how individuals, communities and policymakers respond to issues such as efficient use of resources, strategies for reducing pollution, or ways to improve public transportation.

- Position Detroit as a leader for a sustainable urban transformation through innovation and self-reliance, local business development, entrepreneurship, incubation, and the building of community to encourage regional cooperation, pollution reduction and building and site stewardship practices which maximize efficiency through the management of energy and water. The center will become a sustainable catalyst to the region, expanding the image of Detroit as a viable sustainable green economy.

The **Detroit Sustainability Center** program is separated into several interconnected programs.

1. Community Learning Environment

In essence, the **DSC** facility will act as a laboratory for research on sustainable practices, technologies and initiatives, situating itself as a local leader in sustainable living and design. The **DSC** will perform at the vanguard of sustainable practice; allowing continual systematic analysis of energy consumption, water use, natural ventilation, daylighting, temperature and waste recycling. The **DSC** will facilitate continual user monitoring of the engineering systems, promoting direct user education of the sustainable technologies in use. The research component of the **DSC** will allow for continual analysis, evaluation and life cycle costing of the building processes, creating opportunities for information sharing and potential partnerships with users and other sustainable leaders on a local, national and international stage. The **DSC** will be the first building of its kind in Detroit. It will convey practical knowledge and a hands-on education to the local and metropolitan community; promoting a leadership role in the development and integration of sustainable building technologies and strategies.

Information will be disseminated to the public and building visitors through the following communication outlets:

- Circulation spine and tours
- Monitoring lab and display screens
- TA Hotline (SMSBF)
- Exhibition spaces
- The Map Room
- Green Café
- Resource Library
- Youth on Patrol Against Pollution (YOPAP)
- Website
- Virtual tours to minimize visits

Information will be transferred and shared by professionals and researchers through the following mechanisms:

- Website
- Sustainable Solutions Lab
- Green Jobs Training (BUD)
- Publications of measurement, verification and annual building assessments
- Monthly Lecture series in Public Education Event Room
- Partnerships with local undergraduate & graduate programs
- Training and certification

Information will be distributed to the wider public via:

- Potential Partnerships with Detroit Science Center, University of Michigan, Lawrence Technological University, University of Detroit, Wayne State University etc.
- Link the DSC building monitoring system to a live display at the Detroit Science Center, allowing visitors at the Science Center to learn about the elements being measured and tracked in the DSC building.
- Website
- Media links - generate "free" publicity
- Work with local filmmaker to develop a documentary on the design process of the DSC project to be used as an educational tool.

2. Sustainable Education Provider

The **DSC** facility will aim to address the current shortage of skills and sustainable construction knowledge within the industry through the provision of classroom space; a model home laboratory and a comprehensive workshop for up to 70 construction students as part of the 'Build Up Detroit' program. As previously mentioned, the building will act as a "Living Laboratory", providing students with a direct hands-on approach to their education.

- Green Jobs Training Program - Utilize the building and resources in partnership with manufactures and authorities to advance knowledge of sustainable design strategies leading to green job creation and workforce development.
- Continued development of a Model Neighborhood
- Community engagement to empower citizens of Detroit to take ownership of community revitalization through education and participation.

3. Industry Incubator and Resource Hub

The **DSC** will be open to the public as a resource to communicate and demonstrate many of the design features inherent in the project. It will endeavor to become the nucleus and meeting point for local industry trades and associations. The **DSC** will strive to bring contractors, suppliers, students, researchers, educators, architects and engineers together to establish synergies and promote partnerships while increasing industry awareness of evolving construction trends, materials and project strategies pertaining to sustainable design.

- Building design to include a sustainable solutions lab to act as an incubator for small businesses pursuing environmentally sustainable practices.
- Serve as a 'think tank' for sustainable economic development – developing sustainable industries in fields such as deconstruction, energy efficiency, renewable energies, phytoremediation, recycling, green chemistry & green landscaping
- Partnering with South East Michigan Sustainable Business Forum (SMSBF) to provide technical assistance to new and existing businesses that desire to reduce their carbon footprint.
- Building design to include a 'Green Café' serving locally grown food, with space for a resource library and community workshop on sustainable living and environmental justice.

The Detroit Sustainability Center
Design Approach

The design approach for the rehabilitation and adaptive reuse of the existing auto body repair shop at 10123 Grand River Ave. East is a complex issue requiring a broader scope than a singular building design approach. It is imperative to understand the existing context for all of its limitations and latent potentials, and its relevance to the project vision.

Located on the South-East corner of Grand River Ave. and Prairie Street in Detroit, the prospective location for the DSC presupposes a future quite different from the existing contextual surroundings in terms of overall planning and formal quality. The notion of an extended business corridor along Grand River Avenue East with minimal setbacks, pedestrian oriented streets, and a hub of urban activity is both an exciting and challenging endeavor. An epicenter of activity exists to the North in the form of the Straight Gate International Church which will provide adequate parking for use by the patrons and staff of the Detroit Sustainability Center. Dense single family residential neighborhoods surround the facility to the North, East and West. Direct access to the South is severed by the Jefferies Freeway (I96) but pedestrian access exists along Grand River Ave.

Potential for the expansion of the DSC site exists to the West where the existing stub of Prairie St. extends south from Grand River Ave. East, intersecting the I96 Service Drive. As the I96 Service Drive peels to the north and intersects Grand River Ave. approximately 200 feet to the West of the DSC property line, a resultant pie shaped piece of property exists which is to small to be developed The project team has approached the City of Detroit to discuss the viability of utilizing adjacent portion of Prairie Street as an on-site drive for the DSC and allowing the DSC site to extend to the West, enveloping the adjacent City property, creating a community accessible sustainable park and garden space and would be maintained by the Detroit Sustainability Center. The image below identifies the expanded DSC site.

Our design approach introduces a series of site and building interventions which are restorative in nature through the introduction of useable and high quality green space, addressing the urban street edge, minimizing impervious paving and providing a pedestrian friendly and accessible environment. The intention is to create a small campus for the Sustainability Center with both an internal and external identity.

Site Approach

The conceptual site plan for the Detroit Sustainability Center reinforces the vision for the facility, and provides a tangible, real display of integrated green infrastructure strategies that will be part of the basis of the green training and education activities at the facility. Job trainees will learn and collaborate in a healthy, authentically Detroit setting that incorporates hands-on opportunities to construct, maintain, monitor, and steward actual green systems and materials such as green roofs, porous pavement, and bioretention features.

The following "sustainable urbanism" and green infrastructure practices can be integrated into the site and surrounding area over time to provide a wide range of benefits as part of a green neighborhood revitalization effort:

- Green Roof- Green roof technology is integrated into the structure and covers much of the building- a thinner, lightweight extensive green roof system will provide better insulation, reducing energy needs for heating and cooling, and can be managed for urban-appropriate biodiversity.

- Green Roof Terrace- The green roof terrace provides an accessible, highly visible display of the value of roof space in an urban environment, and overlooks the public plaza. Seating and hardscape areas are complimented with lush perennial plantings kept healthy with harvested rainwater.

- Water/Art Rainwater Harvesting Feature- Surplus roof water is directed to one of two storage cisterns on the north and south side of the building. The north cistern could be part of an artful water display that illustrates water as an art form to enhance the urban streetscape. Outdoor seating, plantings, and local materials could be integrated into functional art as a demonstration of regionally-relevant green infrastructure.

- Service Yard- The service yard provides working area for the facility, material staging, etc. It includes in-site facilities to maintain the green infrastructure, including a greenhouse, rainwater storage, composting, recycling, and materials storage. The yard would be constructed of high-performance, porous interlocking concrete unit pavement, helping to slow, collect, cleanse, and infiltrate rainwater. The yard would be visually screened with trees, green walls, and plantings.

- Public Plaza- The public plaza space provides a visible display of a number of green infrastructure practices- High performance, interlocking concrete pavement helps to slow, cool, and cleanse rainwater, which is then directed into a water cleansing biotope, which also serves as an interactive water feature. The plaza provides outdoor learning and gathering space; outdoor seating in the plaza is enhanced with shade trees planted in appropriately engineered soils to maximize their lifespan and vitality. Perennial grasses and flowers arranged in planters thrive with harvested rainwater stored in cisterns. Prairie Street is shown as being reconfigured, and incorporated into the plaza, elevated with a

"speed table", which maximizes utility of the plaza while still allowing some vehicular use such as a drop-off for local school buses.

- Prairie Hillside- Any surplus rainwater is directed to level flow spreaders that could be installed along the south side of the service drive, which would help support a restored prairie landscape. The restored prairie would provide air and water quality and habitat benefits, while beautifying the right-of-way.

- Wind Energy – To further demonstrate other sources of renewable energy at the facility. Its location, within the right-of-way, [Requires collaborating with MDOT] would identify the DSC from the Jefferies Freeway. The structure could allow an opportunity to be an artful piece representing the strength of the local arts community in Detroit.

- Green Streetscape- Street trees are proposed to provide shade and cooling, absorb rainwater, provide habitat, and improve air quality. Stormwater planters help slow, cool, and cleanse surface water runoff, and provide a pedestrian buffer. A crosswalk provides a safe connection to shared parking across Grand River Avenue.

Existing Building Assessment

Summarized from the Structural Engineering Investigative Report dated 08.05.2010


A cursory review of the existing single story auto body repair identified three distinguishable areas with a partial second floor space along the Northwest portion of the building above the main entrance from Grand River Avenue:

- The Eastern portion of the building is an irregular shaped one story structure which includes a two-bay garage area. The existing roof construction consisted of 3 ft. x 6 ft. light weight pre-cast concrete panels supported by roof steel beams. The steel beams are bearing on Concrete Masonry Unit walls. The north wall consists of Concrete Masonry Units with Brick Veneer. The floor is a concrete slab on grade with trench drain and some embedded steel tracks.
- The main body of the building was an open bay repair area. This one story section is roughly trapezoidal in shape with two high-bay garage doors located at the east and west end of the building. The existing roof construction consists of 3 ft. x 6 ft. light weight pre-cast concrete panels supported by roof steel beams and trusses which are supported on steel columns spaced 20 feet apart along the north and south exterior walls. The existing roof is a gable structure with a small flat portion at both the East and West ends. The exterior walls consist of Concrete Masonry Units with Brick veneer infill forming the sill wall under the sash windows and a supported block and brick wall above. A partial basement is located at the southwest corner of the building. The existing floor is a concrete slab on grade.
- The Northwest section of the building consist of a one story show room | lobby area and a two story administrative space with two sets of stairways leading to separate second floor spaces. The low roof over the show room | lobby

area and the high roof over the two-story area are flat roof with 3 ft. x 6 ft light weight pre-cast concrete panels supported on steel beams and columns. The exterior wall is an aluminum framed glazing system with supported brick and block above. The second floor framing consists of poured concrete slab on metal forms supported by steel beams and columns. The first floor slab is a concrete slab on grade.

Generally speaking, the existing building is structurally adequate with some repair required along portions of the roof framing trusses where some of the steel has corroded. As a result of additional corrosion of the steel lintels at the window opens and extensive water and ice damage, the existing brick and masonry backup would need to be removed for repairs and allow for new lintel installation to be completed. For the most part, the existing brick could be cleaned and reused. The existing roof deck has deteriorated beyond repair and would need to be replaced. Due to the extent of repairs required in the concrete slab, it may be far more economical to remove and recycle the existing slab-on-grade and replace with new concrete.

The insertion of the exterior and interior programmatic elements of the Detroit Sustainability Center presents an opportunity for an analysis into the adaptive reuse of an existing industrial facility; endeavoring to present a sense of place and act as a catalyst for expansion and renewal in a neighborhood pocketed with urban blight.

New Building Proposal

The introduction of six inter-related yet separate program elements within the existing building will integrate the existing facility into a cohesive whole. The primary program consists of a Green Jobs Training workspace and model home lab; a YOPAP (Youth on Patrol Against Pollution) component; a BUD (Build Up Detroit) component; all supported by a public sector consisting of a green café, resource library, exhibit | event space and a sustainable solutions lab. A seminar room and demonstrative mechanical zone are contained above the event space and Green Jobs Training in a glass enclosed mezzanine level. The Administrative and Executive program components occupy the existing second story space of the building, establishing a visual connection to main entrance while taking advantage of a northern daylighting orientation and minimized solar heat gain. An adjacent swath of LED infused media mesh, at the building exterior, provides a marketable identity for the DSC with its proximity and views along Grand River Avenue East.

In response to a deep industrial floor plate, the addition of passive sustainable strategies (rooftop light monitors, operable windows and light tubes) will increase the amount of daylight and natural ventilation to the building; around which the interior programmatic spaces are organized. The interior design strategy is crafted around the notion of volumetric intervention within the found object – where the programmed spaces occupy rooms set within the larger volume of the existing building. These interventions coupled with a dematerialized interior design approach (where unnecessary building finish materials are reduced or eliminated; ie. column wraps, perimeter drywall, ceiling systems and unnecessary floor coverings etc.) assert an opportunity for a more critical set of solutions to the programmatic concerns, retaining the character of the original structure, and presenting an authenticity in the use of materials.

Material Palette

The materials designated for the project are minimal and intended to reference continuity with the character of the existing architecture and context of the surrounding neighborhood.

- Reuse of the primary steel structure is intended and will be supported with additional steel structure as required.
- New CIP (cast-in-place) concrete slabs will be polished to a terrazzo finish and a sustainable flooring material (cork, bamboo, recycled carpet etc.) selected for offices and classroom spaces requiring more comfort underfoot.
- Reuse of the existing brick on both the exterior shell and interior walls will reduce the amount of material contributing to the waste stream process and will become a critical component in the sustainable development of the project. Reclaimed brick secured from the existing building site will result in an environmental impact of virtually zero. In addition to this advantage, the larger exterior brick walls will act as a thermal mass, mediating interior temperatures and contributing to the overall energy efficiency of the building.
- A Composite Wall Panel Rainscreen (Trespa) is a high performance system which will help ensure that the building is weather-proof, dry and well-insulated, creating a comfortable and healthy environment in which to work and live. In addition, the material will help to unify the building, aesthetically compliment the existing brick and corten steel and provide a compatible relationship between modern and aged construction systems. The product is sustainable, constructed from 85% rapidly renewable material with high LEED point potential.
- Highlighting various points of entry to the building are Corten steel panels. Corten is a weather resistant steel comprised of a copper chromium alloy and displaying a greater level of resistance to atmospheric weathering than many other unalloyed steels. When exposed to the elements, the chemical composition promotes the early formation of an adhering protective layer of rust. The benefits of such a product are immediately obvious – a self–protecting steel is economic, long lasting and easily recyclable while providing a unique and identifiable aesthetic to the building.
- Insulated and high performance glazing is an essential component to the energy efficiency of the overall design. In addition to providing increased insulation values and low-E coatings which reflect radiant heat; strategic placement of windows and openings will maximize views to the exterior, which possess demonstrably beneficial characteristics to the well being and productivity of the building occupants.

DSC

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Proposed Site Plan

DSC

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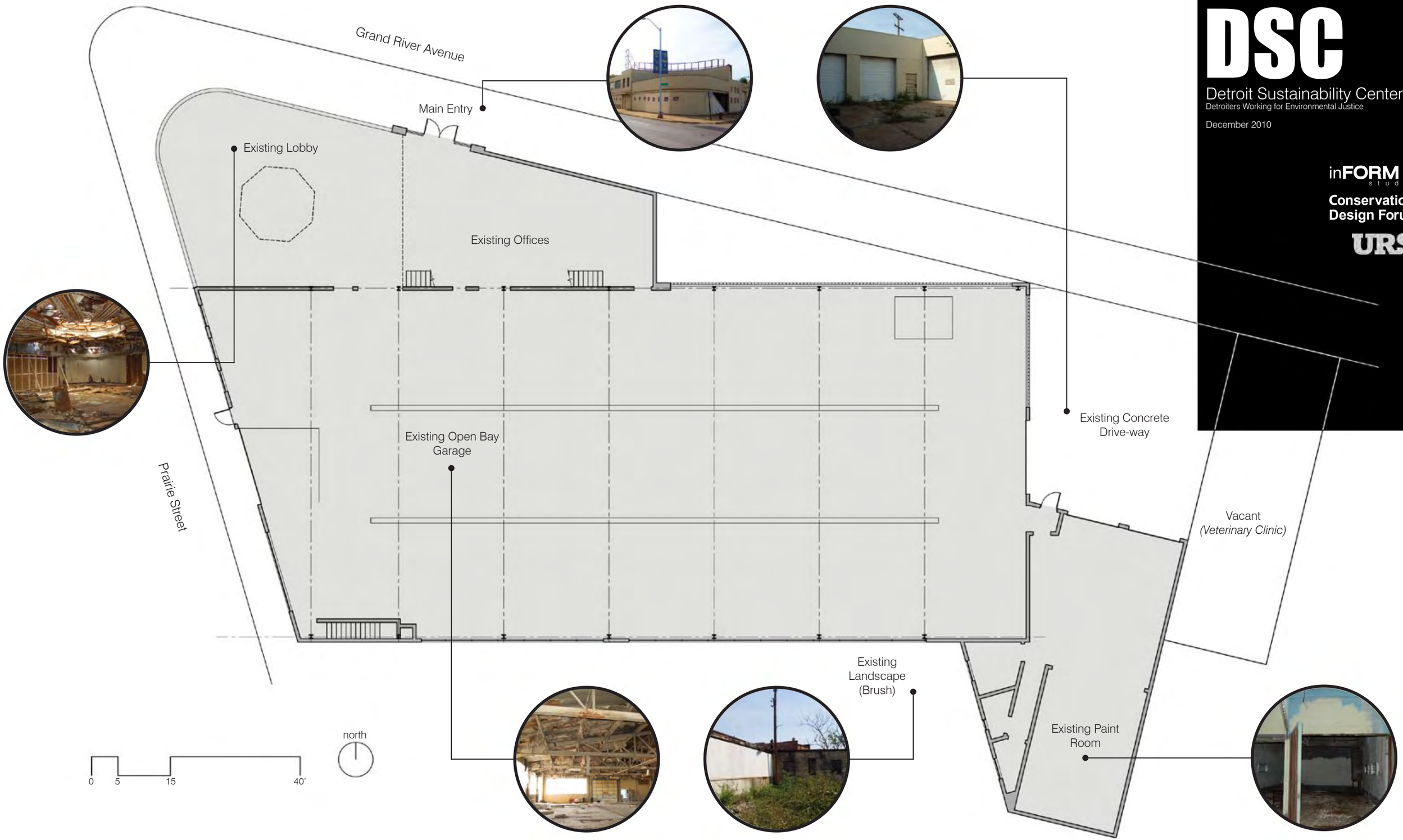

Existing Floor Plan

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Proposed Main Floor Plan

DSC

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Proposed Mezzanine Floor Plan

DSC

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Exterior Lighting

Opportunities to use LED technology for site and builidng permiter lighting will result in lower maintenance and energy savings. Cut-off type luminaries will minimize light pollution and light trespass to adjacent properties.

Green Wall

Also referred to as living walls, biowalls, or vertical gardens, the free-standing Green Wall is completely covered with vegetation and provides many advantages to the building and occupants. These include the improvement of indoor air quality; energy savings through the reduction in cooling requirements and mitigation of the urban heat island effect & the potential for urban agriculture or urban gardening.

Photovoltaic Cells (PV)

A demonstrative zone providing hands-on experience with a PV crystalline panel system will contribute to a more sustainable facility while improving the power distribution system through a renewable energy source.

Proposed South Elevation

0 5 15 40'

Extensive Green Roof

A "vegetated" or "living roof" consists of a thin layer of drought resistent, native plants installed over a conventional roof. Properly designed, they are stable, living ecosystems which replicate many of the processes found in nature.

Benefits include;

- Controlling stormwater runoff and erosion
- Improving water quality
- Mitigating urban heat-island effects
- Conserving energy
- Creating wildlife habitat

Rain Garden

Designed to withstand the extremes of moisture and higher concentrations of Nitrogen and Phosphorus in stormwater runoff. They are ideally sited close to the source and slow the water to allow for infiltration and reduction of erosive power.

Reclaimed Brick

Reuse of the existing brick reduces the amount of material contibuting to the waste stream process, and is a critical component in the sustainable development of the project. The use of reclaimed brick secured from the existing building site results in an environmental impact of virtually zero. Additionally, the brick walls create a thermal mass, mediating interior temperatures and contributing to the overall energy efficiency of the building.

Corten Steel

A weather resistant steel which is a copper chromium alloy which displays a greater level of resistance to atmospheric weathering compared to other unalloyed steels. When exposed to the elements, the chemical composition promotes the early formation of an adhering protective layer of rust

The benefits of such a steel are immediately obvious – a self–protecting steel is economic, long lasting and easily recyclable.

Composite Wall Panel Rainscreen (*Trespa*)

Trespa Panels can be used for the construction of ventilated external walls. This high performance system will help to ensure that the building is weather-proof, dry and well-insulated, which in turn will create a comfortable and healthy environment in which to work and live.

Solatube

Solatube is a passive daylighting component which channels light through a tube containing an internal reflective system. It is capped with a transparent, roof-mounted dome 'light collector' and terminated with a diffuser assembly which admits natural daylight into interior spaces and distributes the available light energy evenly and efficiently.

Proposed North Elevation

0 5 15 40'

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Sun Shading Device

A well designed sun control or shading device can dramatically reduce building peak heat gain and cooling requirements while improving the natural lighting quality of building interiors. Depending on the amount and location of fenestration, reductions in annual cooling energy consumption of 5% to 15% have been achieved. Sun control and shading devices also improve user visual comfort by controlling glare and reducing contrast ratios.

Geothermal Sidewalk Snowmelt

A geothermal snowmelt system enhances the sustainability aspects of the project with several benefits, including:

- Elimination of cost and inconvenience of snow and ice removal.
- Reduced wintertime liability exposure from slick sidewalks.
- Reduced mess and inconvenience in buildings from tracked-in sand, salt and slush.
- Elimination of damage to sidewalks and brick pavers from freeze-thaw cycles.

Natural Ventilation

Natural ventilation utilizes the existing building's form, organization, and openings in conjunction with naturally occurring phenomena such as wind or warm air buoyancy to supply air to its occupants and to remove heat.

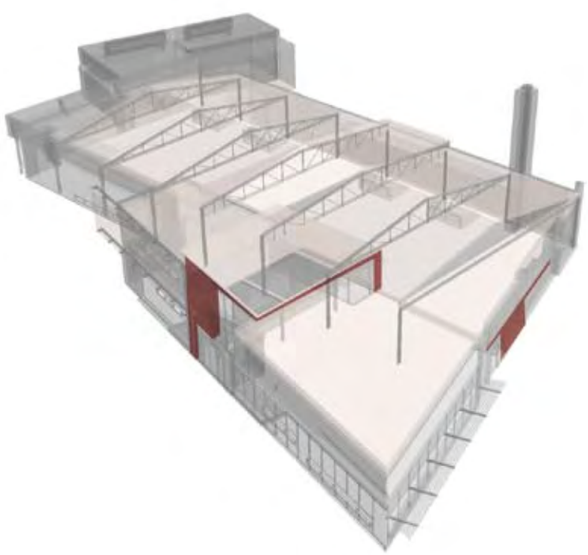
- Reduction in operating costs by decreasing the power used to mechanically ventilate and cool.
- Reduction in construction costs by downsizing or eliminating the cooling equipment.
- Reduction of building energy use and environ mental impact caused by power generation.

0 5 15 40'

Proposed West Elevation

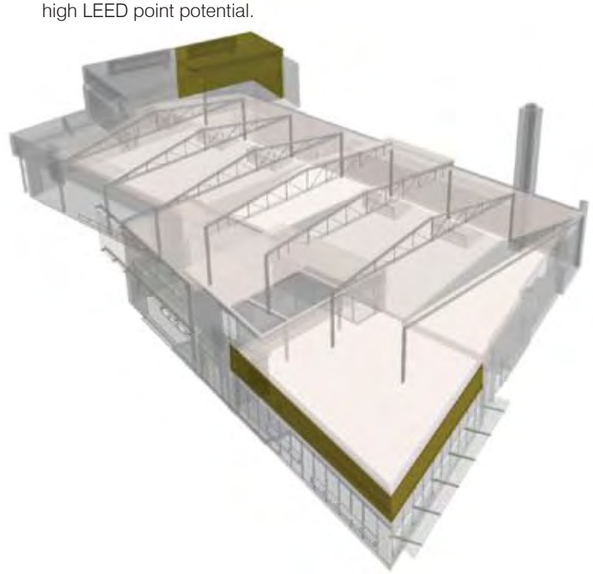
Corten Steel

- Weather resistant steel
- High level of resistance to atmospheric weathering
- Economic and long-lasting
- Easily recyclable
- Excellent urban aesthetic



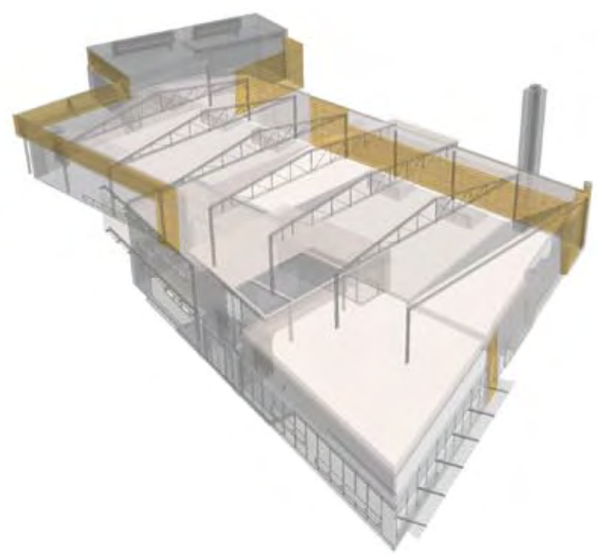
Composite Wall Panel Rainscreen

- Innovative and functional ventilated rain screen cladding system.
- Material unifies the building envelope and compliments the existing brick and corten - providing a comfortable relationship between old & new.
- Sustainable product - 85% rapidly renewable material with high LEED point potential.



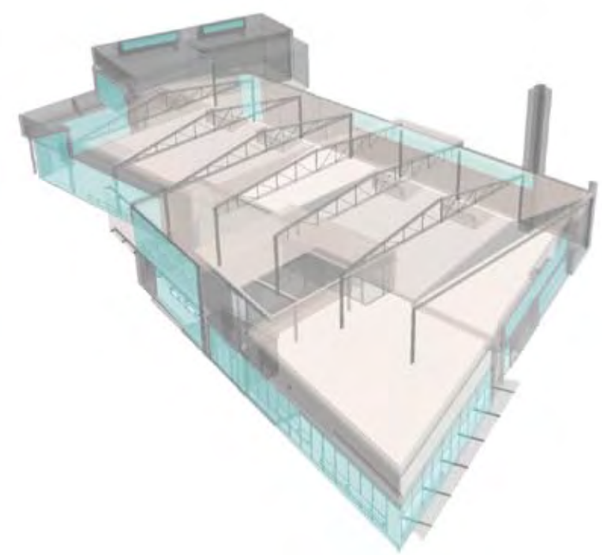
Reclaimed Brick

- Use of reclaimed brick reduces the amount of material contributing to the waste stream process.
- Creates a thermal mass to aid in the mediation of interior temperatures and contributes to the overall energy performance of the building.



Insulated Glazing

- Essential energy efficiency including high insulation values,
- low-emissivity coatings to reflect radiant heat, low glare and
- high visual clarity.
- Maximize views to the exterior which possess preferred and
- demonstrably beneficial characteristics to the building occupants.



Material Study

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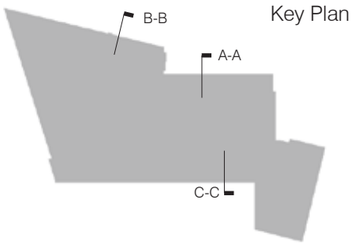
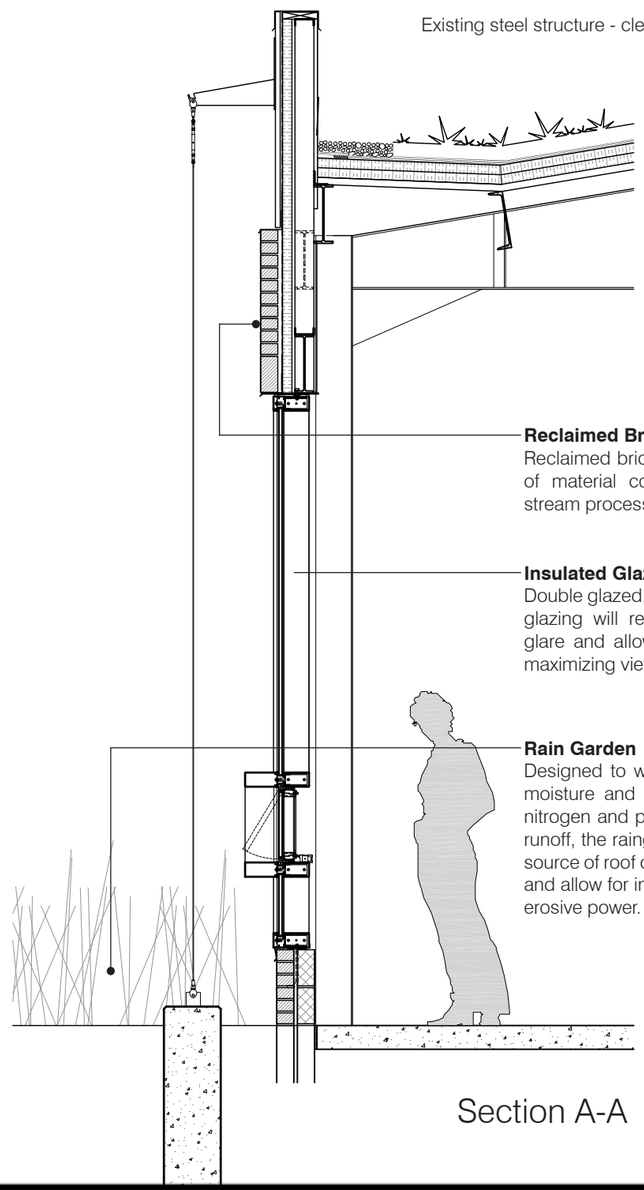


Key Plan

Second Floor Construction
Polished concrete (or sustainable floor covering) over;
Metal deck over;
Existing steel structure - cleaned and painted



Reclaimed Brick
Reclaimed brick will reduce the amount of material contributing to the waste stream process.

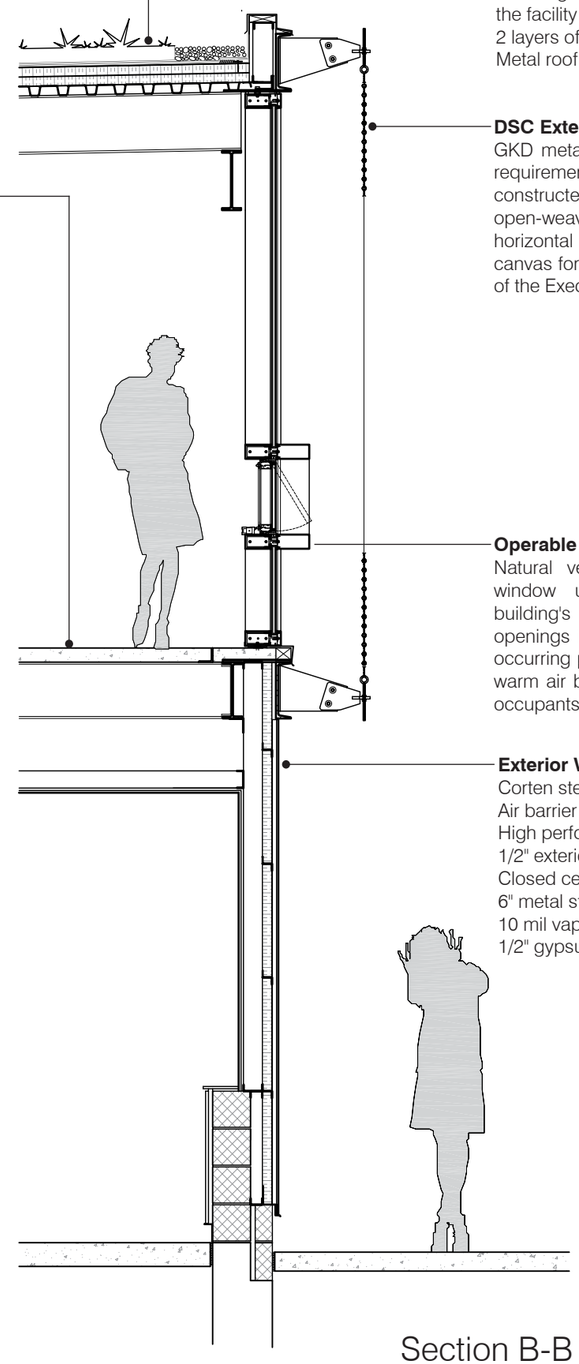
Insulated Glazing
Double glazed, insulated, low emissivity glazing will reflect radiant heat, lower glare and allow high visual clarity and maximizing views to the exterior.

Rain Garden
Designed to withstand the extremes of moisture and higher concentrations of nitrogen and phosphorus in stormwater runoff, the raingarden is sited close to a source of roof drainage to slow the water and allow for infiltration and reduction of erosive power.

Section A-A

Roof Construction
A vegetated roof system designed to retain, slow, cool and cleanse rainwater runoff on top of the building, while reducing the urban heat island effect and reducing heating and cooling energy requirements of the facility over;
2 layers of 2" rigid insulation over;
Metal roof deck

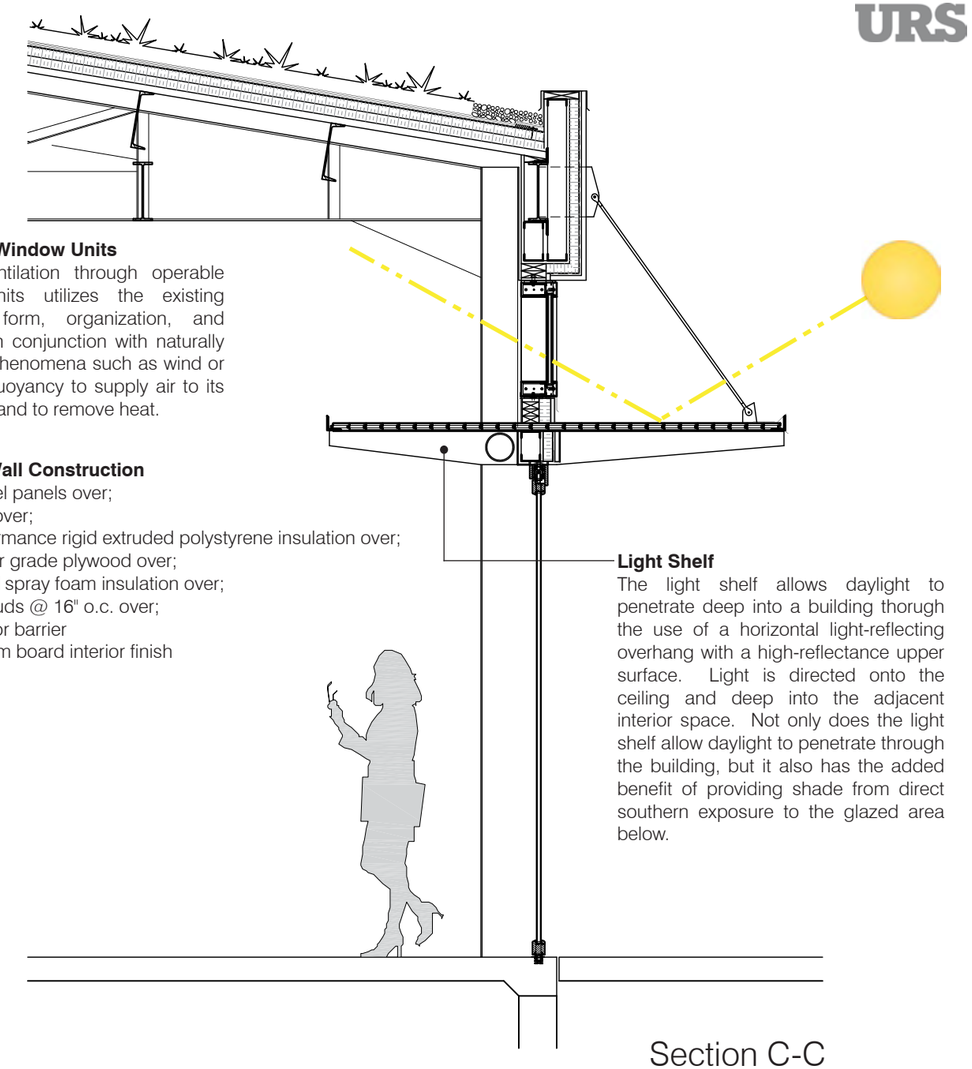
DSC Exterior Sign
GKD metal fabrics are ideally suited to the utilitarian requirement; employing the Futura 3110, a fabric constructed of stainless steel rods and cables. The open-weave fabric is hung on two cantilevered horizontal channels, creating a distinct identity and canvas for DSC signage without obstructing the views of the Executive office area.



Operable Window Units
Natural ventilation through operable window units utilizes the existing building's form, organization, and openings in conjunction with naturally occurring phenomena such as wind or warm air buoyancy to supply air to its occupants and to remove heat.

Exterior Wall Construction
Corten steel panels over;
Air barrier over;
High performance rigid extruded polystyrene insulation over;
1/2" exterior grade plywood over;
Closed cell spray foam insulation over;
6" metal studs @ 16" o.c. over;
10 mil vapor barrier
1/2" gypsum board interior finish

Section B-B



Light Shelf
The light shelf allows daylight to penetrate deep into a building thorugh the use of a horizontal light-reflecting overhang with a high-reflectance upper surface. Light is directed onto the ceiling and deep into the adjacent interior space. Not only does the light shelf allow daylight to penetrate through the building, but it also has the added benefit of providing shade from direct southern exposure to the glazed area below.

Section C-C

Schematic Building Sections

DSC

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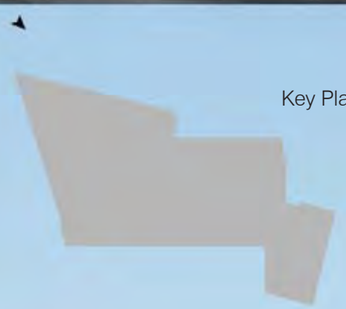
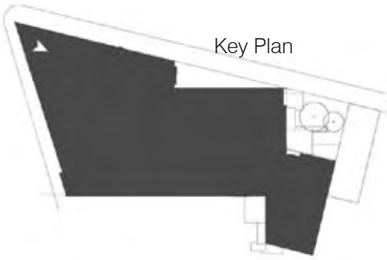


Key Plan

View South East along Grand River Ave.



Interior View - Main Entry | Green Cafe

DSC

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Interior View - Model Home Lab

Overall Energy Performance

A consistent methodology applied to the design process was to achieve a sustainable project through high and low tech means. Reducing the need for energy by optimizing daylight, introducing natural ventilation, and taking advantage of solar thermal heat gain in the winter and minimizing solar heat gain in the summer were determining factors in the massing and orientation of architectural components, form and articulation.

The following is a conceptual engineering analysis for the Detroit Sustainability Center (DSC) and outlines the results of the analysis conducted for the DSC; highlighting the recommendations for the design. One goal of the DSC is to obtain a LEED "Platinum" rating through the Leadership in Energy and Environmental Design (LEED) green building rating system. As part of this requirement, the design will utilize materials and products that have been extracted, harvested, recovered, or manufactured within 500 miles of the project site, for a minimum of 10% of the total materials value.

The DSC project has been designed in a sustainable manner using strategies that can easily be implemented in residential and commercial projects that are suitable for Michigan's climate. The engineering strategies recommended have been assessed for their energy use, carbon emissions, financial sustainability, and application relevance to the metro Detroit region.
The project has incorporated many passive and active sustainable strategies into the design.

The passive strategies include:

- An efficient façade
- Daylight harvesting
- Natural ventilation
- Thermal mass optimization
- Night purging

The active strategies include:

- A high efficiency variable refrigerant flow (VRF) heating and cooling system inside the building
- Geothermal heating and cooling plants tied to the VRF system
- Condensing boilers for auxiliary radiant heat
- Energy recovery through a total energy wheel
- A dedicated outdoor air unit
- Occupancy monitors
- A solar water heater
- A heat pump water heater
- Grey water reuse

A conceptual energy analysis on the DSC found that it uses 27.5% less energy than the baseline building. The model for the baseline building was built using the ASHRAE 90.1 2007 standard.

Mechanical Design

Codes and Standards

This building shall be provided with systems in accordance with the following codes and standards as well as all applicable ordinances:

Building Code

- 2006 Michigan Building Code
- 2006 Michigan Rehabilitation Code for Existing Buildings

Mechanical Code

- 2006 Michigan Mechanical Code
- 2008 Michigan Rehabilitation Code

Plumbing Code

- 2009 Michigan Plumbing Code
- 2006 National Standard Plumbing Code

Electric & Fire Protection Code

- 2008 National Electric Code and NFPA document

Standards

- ASHRAE 15-2007 “Refrigeration Safety”
- ASHRAE 55-2007 “Thermal Environmental Conditions for Human Occupancy”
- ASHRAE 62.1-2007 “Ventilation for Acceptable Indoor Air Quality”
- ASHRAE 90.1-2007 “Energy Standard for Buildings Except Low-Rise Residential Buildings”

Design Conditions

Per ASHRAE 90.1 2007

The outdoor design conditions shall be in compliance with “ASHRAE Handbook of Fundamentals”. The 2009 edition was used to establish the design conditions for Detroit, Michigan (Detroit City Airport), and are as follow:

Summer:	88.3°F DB / 72.3°F WB
Winter:	8.9°F DB
Dehumidification:	72.0°F DB / 121.3 HR / 80.6 MCDB
HDD:	5984
CDD:	898

Room Temperature Set-Points

Room temperature set-points were set according to room type. Rooms that would contain transient occupants and students were prioritized by keeping the set-points in the middle of the comfort zone as defined by the standard ASHRAE 55. The comfort zone is the temperature range in which people are comfortable. Temperature set points for rooms that would contain employees were allowed to drift further from the center of the comfort zone to minimize energy consumption.

Passive Strategy Psychometric Analysis

A psychrometric analysis was conducted for the DSC to determine which passive strategies (strategies that use no energy) would be most effective at conditioning the building. Figure 1 below shows a psychrometric chart which is used to define the conditions of air at different pressures, temperatures, and humidity. The conditions of the air have been overlaid in colors for the different regions of the chart.

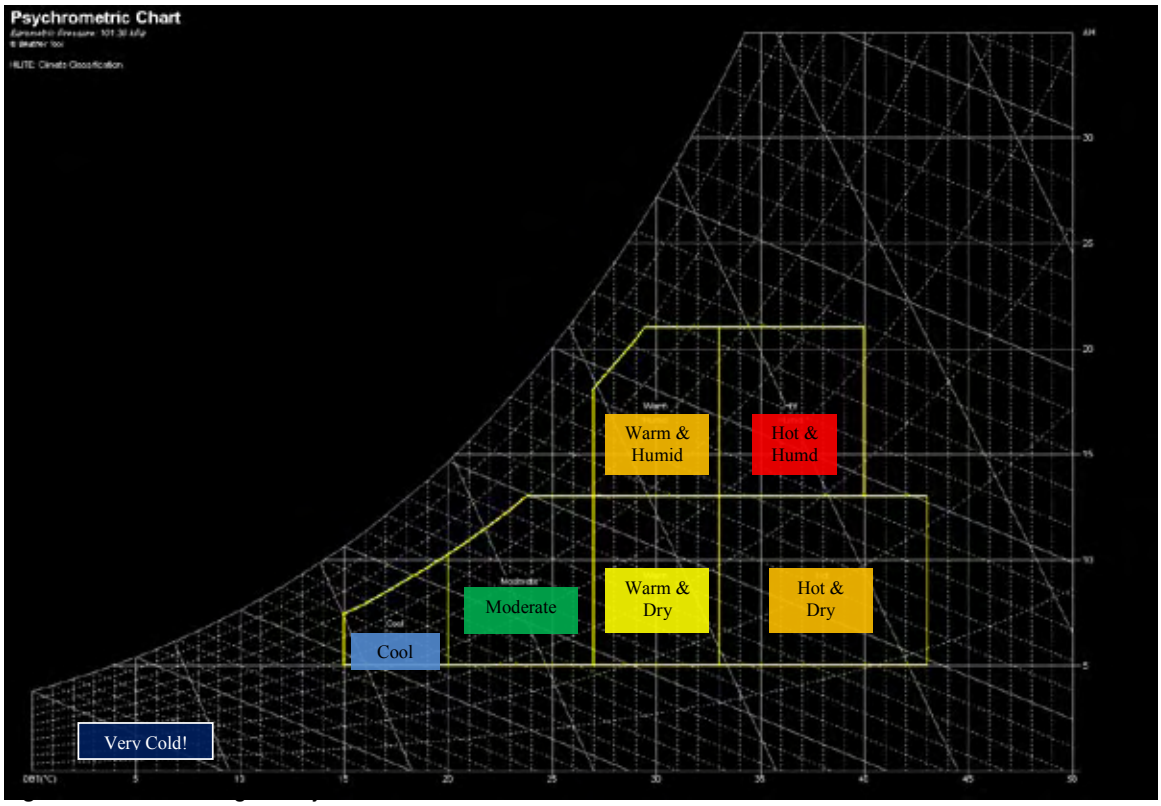


Figure 2 outlines the region on the psychrometric chart that people are comfortable.

This region is indicated by a yellow outline. The varying shades of blue on the psychrometric chart define the number of hours the DSC would be in that zone of the chart. The lighter the blue, the more hours the DSC spends in that region of the chart. Note that the DSC is in the cold and very cold region of the chart for a large amount of time, while it is in the "Hot & Humid," "Warm & Humid," and "Hot & Dry" for a relatively short amount of time

The yellow outline is the comfort zone on the psychrometric chart.

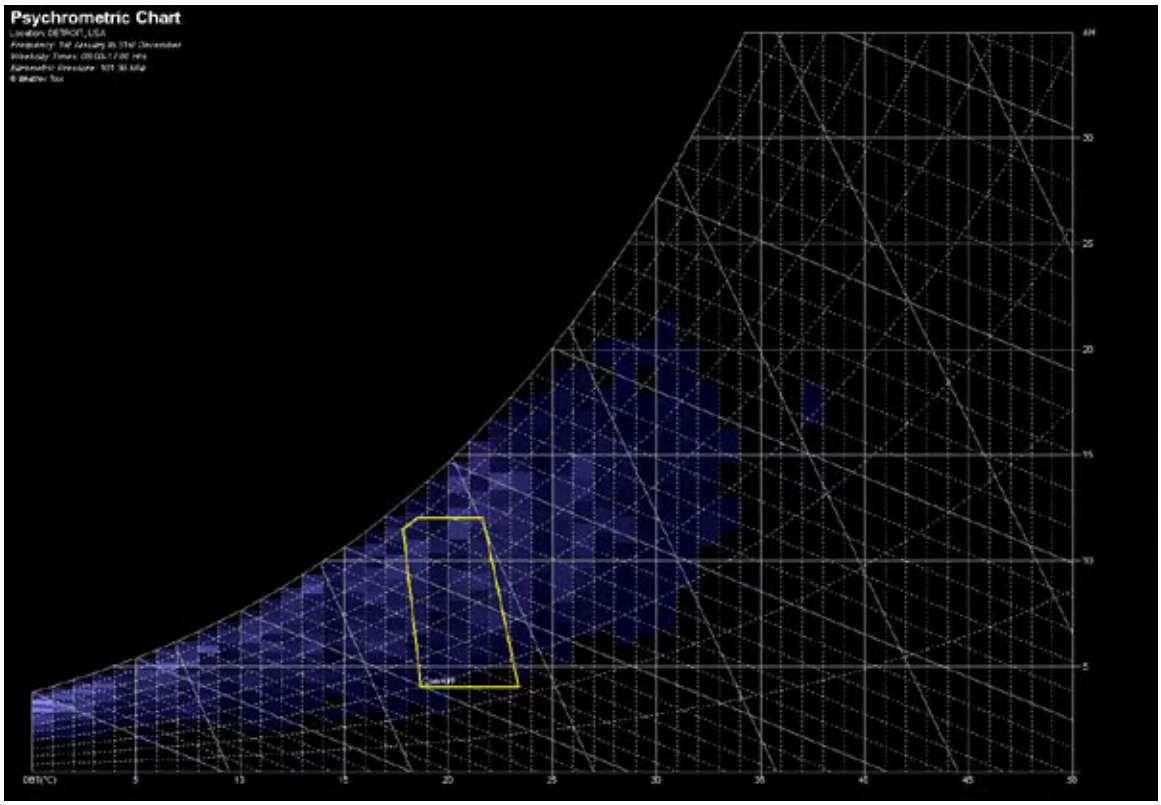


Figure 3 below shows the psychrometric chart from Figure 2 with polygons overlaid on top of the chart.

The polygons represent the passive strategies that were selected to condition the DSC. These strategies include passive solar heating (red), thermal mass effects (blue), exposed mass and night purge ventilation (burgundy), and natural ventilation (pink). The outline of the sum of these strategies defines the number of hours the DSC can use passive strategies while not consuming any energy to condition the building.

The outline of the polygons is the total amount of time occupants are comfortable using passive strategies.

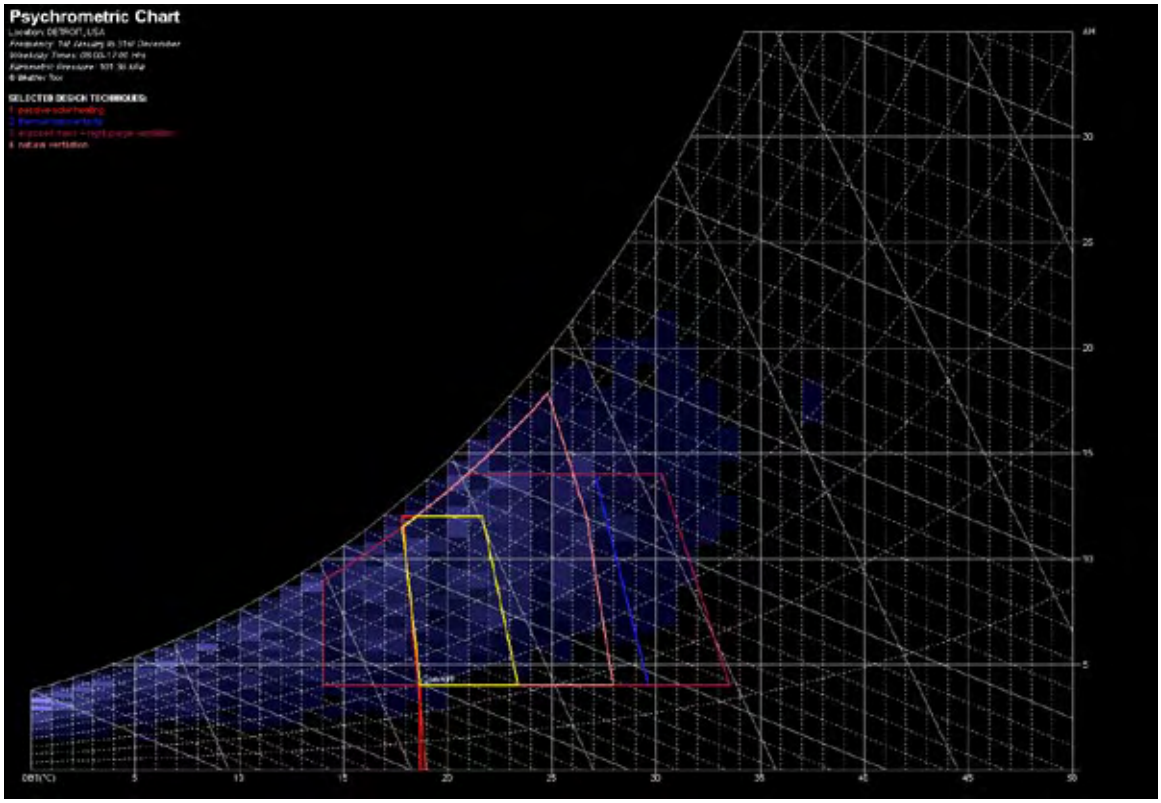
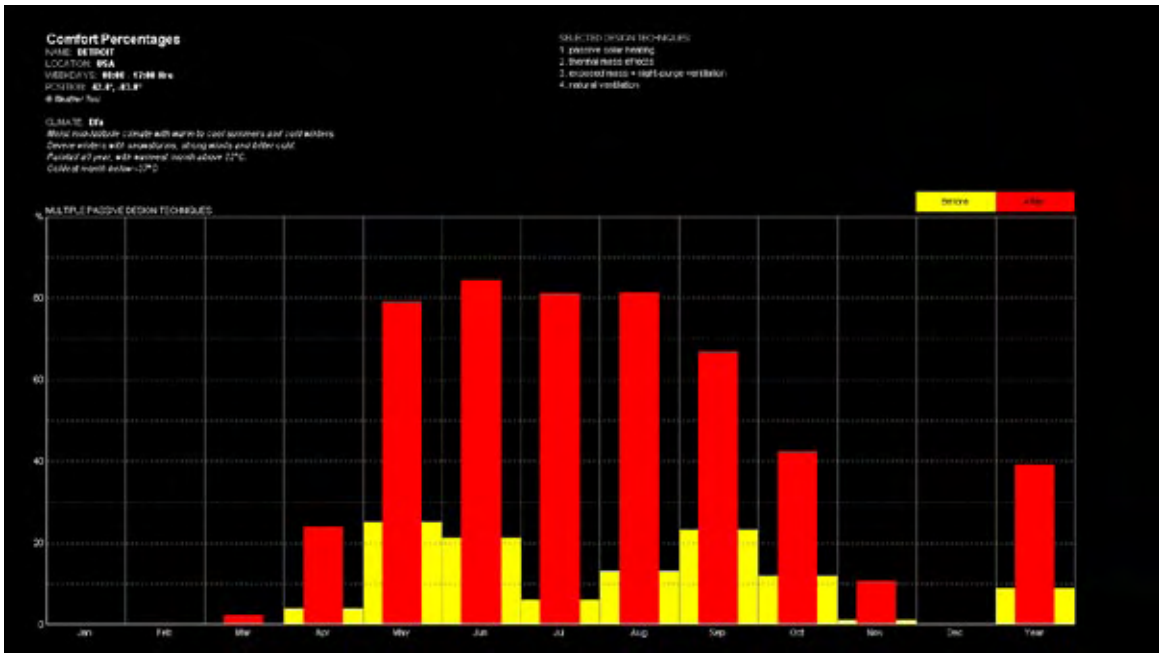


Figure 4 below is a bar graph that breaks out Figure 3 by months on the X-axis, and the percentage

of the time occupants are comfortable using passive strategies along the Y-axis. The graph has two colors, yellow and red. The yellow bar defines the percent of time occupants are comfortable in each month when neither active strategies, such as an HVAC system, nor passive strategies are used. The total time occupants are comfortable without active or passive strategies is about 8% of the year.
The red bar defines the percent of time occupants are comfortable in each month when the assessed passive strategies are used. Utilizing passive strategies increases the amount of time people are comfortable to 39% of the year.
The graph also shows that occupants are never comfortable in the winter months using passive strategies. This mirrors the cold winters of Detroit's climate in which energy must be consumed to heat buildings to achieve occupant comfort.

Using passive strategies increased the amount of time in a year that people are comfortable by 31%.
Red Bar = Passive Strategies
Yellow Bar = No Passive Strategies



Cooling Plant

GSHP (Ground Source Heat Pump)

The cooling plant will consist of a closed loop ground source heat pump (GSHP) system. The GSHP system will contain a geothermal well field sized for 40 tons of cooling capacity and a heat exchanger between the ground loop, and the building loop. The well field will be piped in a parallel arrangement located under the loading area to the north of the building. The loading area will be covered with 100% permeable pavers to allow for rain penetration into the ground. The ground loop will contain two pumps and be setup as a variable volume pumping arraignment allowing heat transfer to the ground to match the building's demand for cooling. These pumps will have the capability of pumping 120 gallons per minute (GPM). Also included with the ground loop will be an air separator with a strainer and an expansion tank.

Future Expansion for Cooling Plant
Future expansion of the GSHP system could be accommodated through additional wells and added heat exchangers. Additional capacity may be incorporated into the final heat exchanger design selection to allow for adding wells without adding additional heat exchangers.

Heating Plant

GSHP
The GSHP system that will provide cooling in the summer time will also provide heating in the winter time. The GSHP system will consist of a geothermal well field sized for 500 MBH of heating capacity. The VRF system that cools the DSC in the summertime will also heat the DSC in the winter.
The GSHP system will also serve as the heating plant for snow melt along the sidewalk and in the court yard of the DSC

Boiler & Radiant Heat
In addition to the GSHP system for heating the DSC there will also be a natural gas fired condensing boiler installed for heating the perimeter rooms of the building. The boiler will be 94% efficient and be sized to handle 35% of the building's heating load. Two pumps will send hot water from the boiler to fin-tube radiators located along the perimeter rooms. The boiler and pumps will be located in the mezzanine level mechanical space.
The heating hot water distribution system will be a variable-primary flow configuration with all coils utilizing two-way modulating control valves.

Future Expansion for Heating Plant
The proposed heating plant has a backup of 35% capacity built into the boiler and fin-tube system serving the exterior rooms. Additional capacity could be incorporated by adding a boiler.

Ventilation

The DSC has been designed to primarily utilize natural ventilation as its sole source for ventilating the building. Natural ventilation is a strategy which requires operable windows to be installed on exterior walls. These windows must be able to be opened and closed by building occupants to allow air to flow through the building. By utilizing natural ventilation nearly no outdoor air is necessary to be introduced into the DSC from the heating ventilation and air conditioning (HVAC) system, which saves a large amount of energy and utility costs. Natural ventilation was designed into the building to reduce operating costs and to increase occupant comfort. The only rooms in the DSC that require ventilation through the HVAC system are interior rooms which have no windows and no permanent openings to exterior rooms.
When natural ventilation is not included in a building's design the HVAC system must use energy to condition outdoor air and fan energy to push the air throughout the building. This additional energy consumption amounts to one of the largest building operational costs over the life cycle of the building.
The DSC has been designed with outdoor temperature and humidity sensors that integrate into motorized operable windows. When the conditions outdoors are pleasant the motorized windows will open promoting natural ventilation in the DSC.
An airflow study was conducted on the DSC to predict the airflow speed and direction in and around the building. The purpose of the study was to optimize airflow through the building using natural ventilation, to find possible problems with airflow around the building, and to ensure proper placement of openings (i.e. windows and doors.)
The airflow study resulted in optimized opening arrangements on the building and minimized areas in the building with high speed gusts. The analysis revealed vortices forming in the outdoor courtyard to the South West corner of the building. These vortices would act as miniature tornadoes and cause debris to collect in the courtyard. Recommendations were made to install shrubs and

plants, or movable partitions to minimize the vortices. The following figures 5, 6, 7 and 8 are some of the images captured from the analysis.

Figure 5 below shows the **airflow speed** at 4 feet above ground level. The yellow color indicates airflow at 2.0 miles per hour (MPH), the red color indicates airflow at 1.0 MPH, and the blue indicates stagnant airflow.

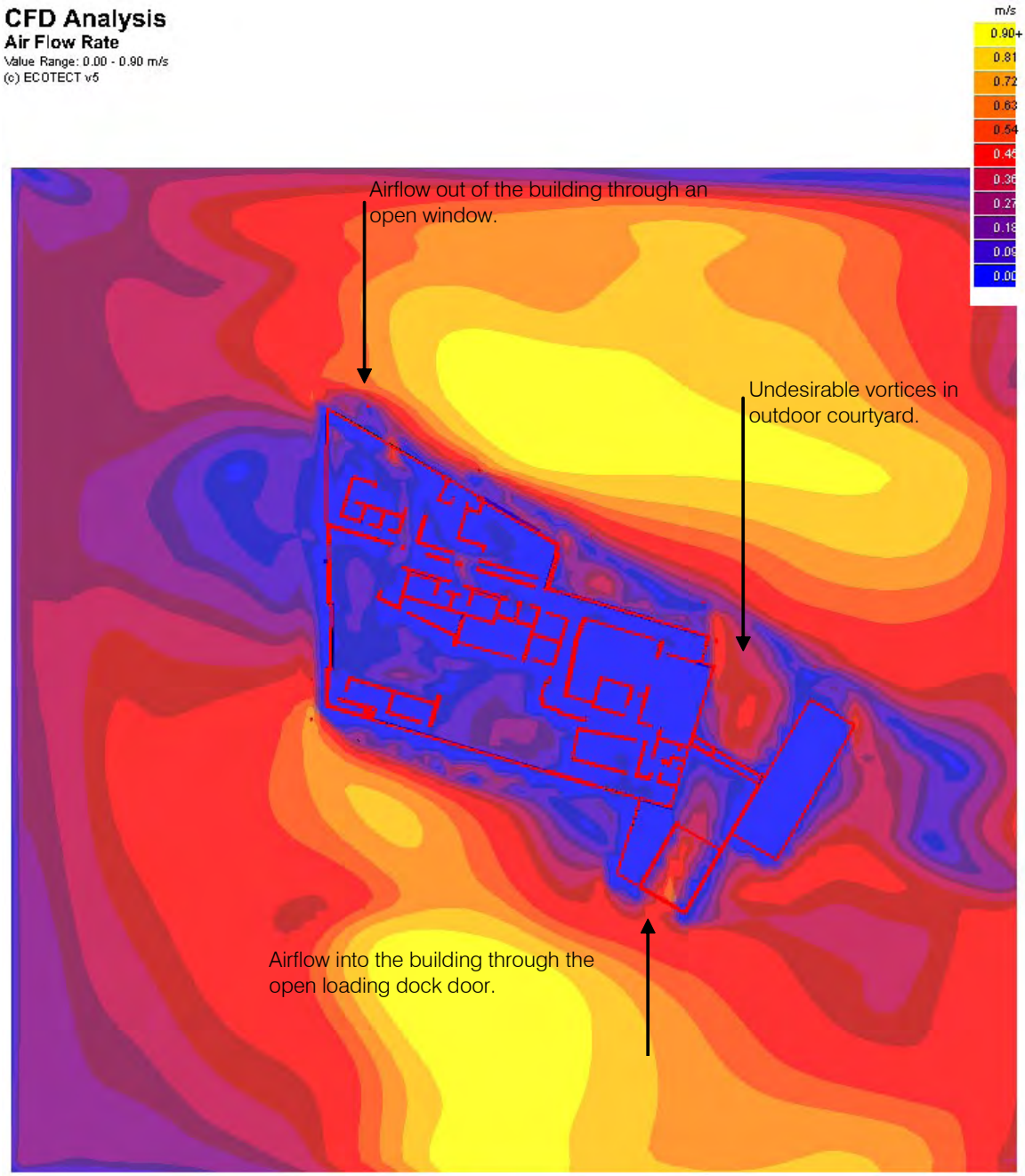


Figure 5 - Airflow Study - Wind Speed at 4 Feet Above Ground Level

Figure 6 below shows the **airflow direction** as indicated by the arrows at 4 feet above the ground level. The yellow color indicates airflow at 2.0 miles per hour (MPH), the red color indicates airflow at 1.0 MPH, and the blue indicates stagnant airflow.

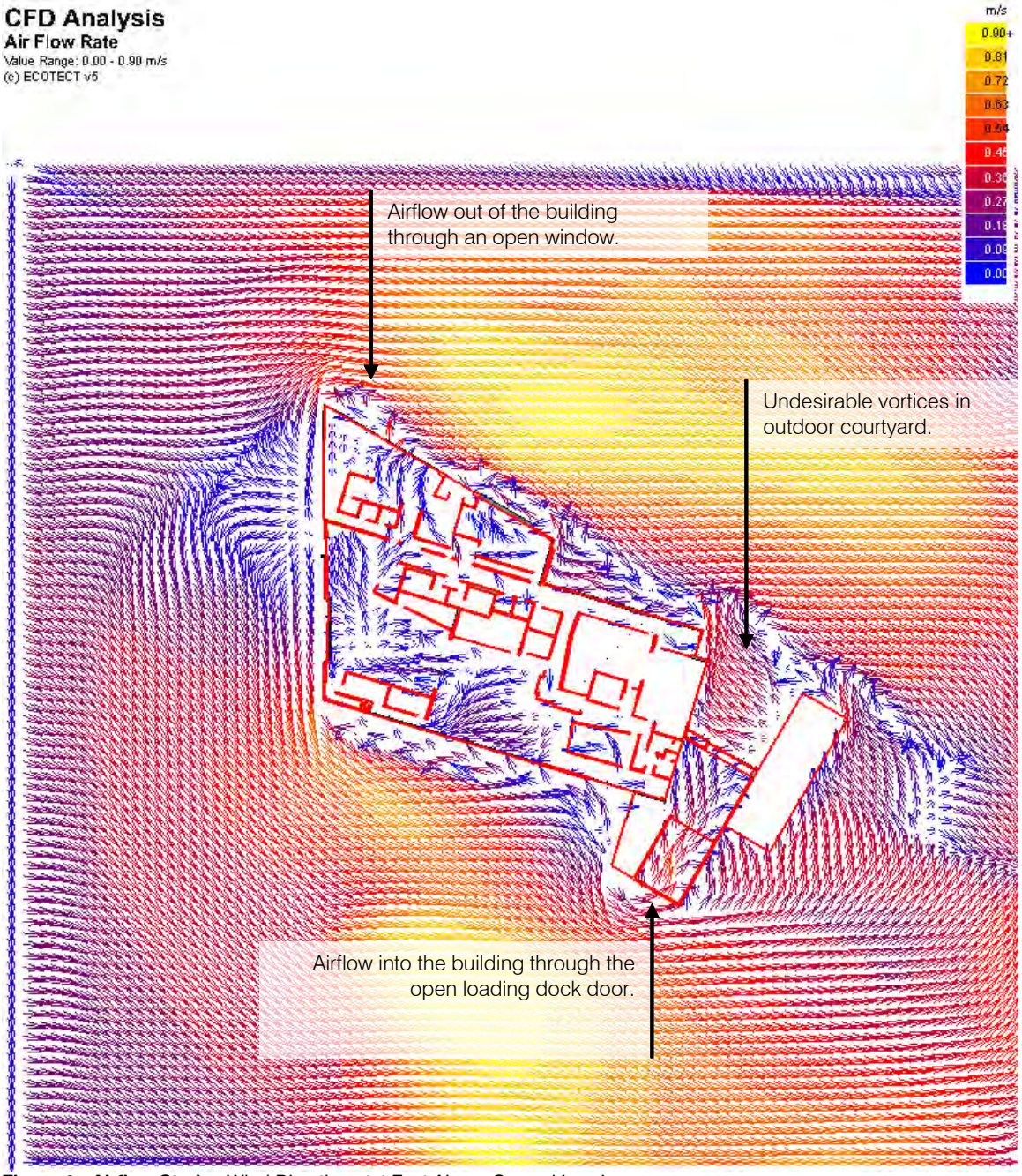


Figure 6 - Airflow Study - Wind Direction at 4 Feet Above Ground Level

Figure 7 below shows the **wind speed** at the loading dock door. The yellow color indicates airflow at 2.0 miles per hour (MPH), the red color indicates airflow at 1.0 MPH, and the blue indicates stagnant airflow.

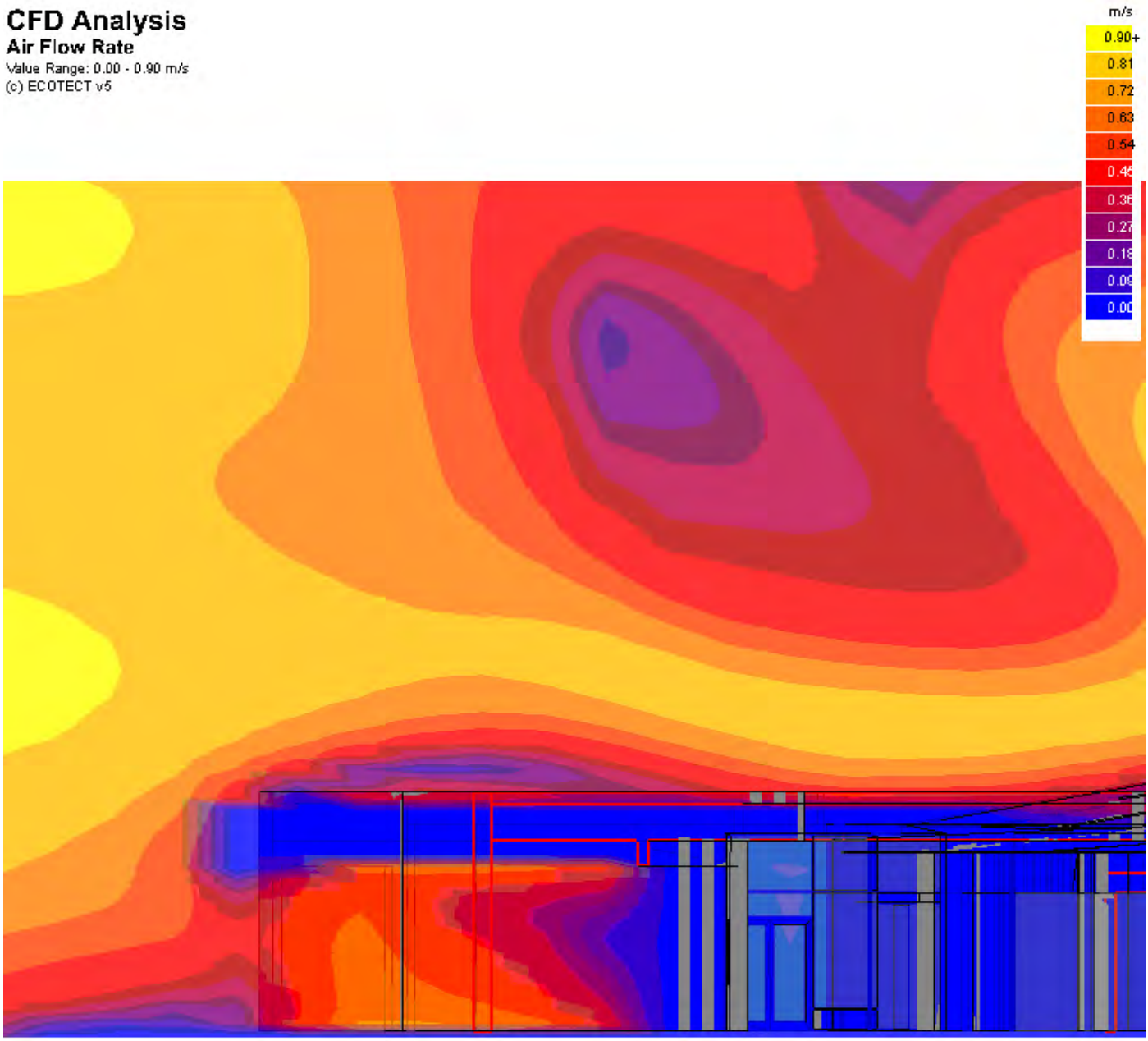


Figure 7 - Airflow Study - Wind Speed Through Open Loading Dock Door

Figure 8 below shows the **wind direction** as indicated by the arrows at the loading dock door. The yellow color indicates airflow at 2.0 miles per hour (MPH), the red color indicates airflow at 1.0 MPH, and the blue indicates stagnant airflow.

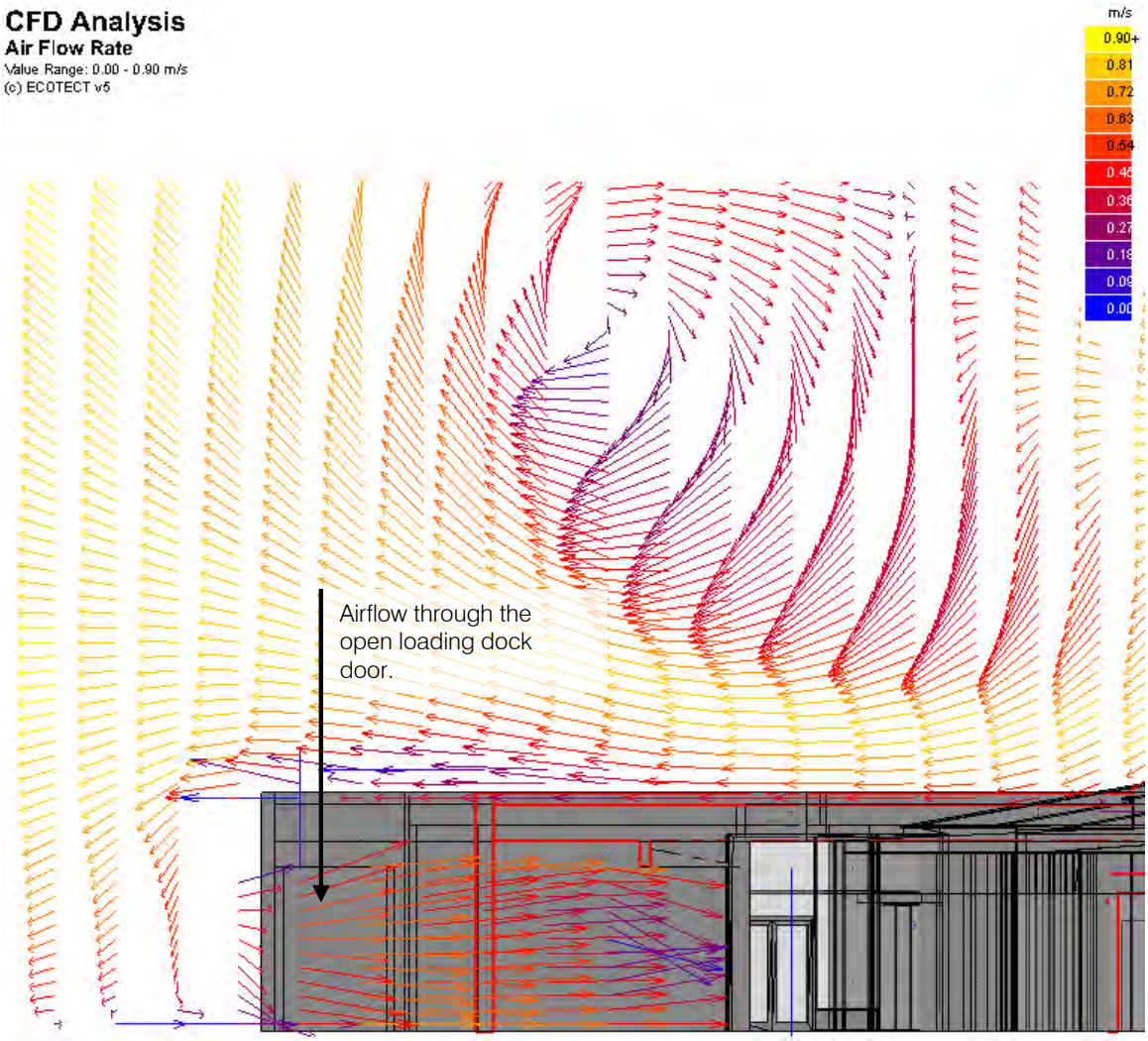


Figure 8 - Airflow Study - Wind Direction Through Open Loading Dock Door

Air Distribution

Variable Refrigerant Flow (VRF) & Terminal Units
The DSC will be conditioned using a VRF system, which will be placed in the mechanical mezzanine space. A second component to the VRF system is terminal units. These units will be placed in the ceiling space in each room.
This system will transfer heat between the well field and the building. In the summer it will transfer heat from the building into the ground, and in the winter it will transfer heat from the ground into the building. Each room will have at least one terminal unit. The terminal units will recirculate air within each room. The units will be capable of heating and cooling the recirculated air. The VRF system will also serve as a heat pump to move heat between rooms within the DSC. Rooms that need cooling will have their heat moved to rooms that need heating and vice versa. Additionally when the building needs more heat that the occupants, lights, computers and other equipment are generating, the VRF system will then use the heat available from the well field. In the summer time when rooms need cooling the VRF system will reject the DSC's heat to the well field, storing it to be used during winter months. Because the VRF system can move heat within the building, the extra energy associated with creating heat or removing it, as with a boiler and compressor, can be eliminated. This produces further energy and utility cost savings over a typical boiler and compressor arrangement.

Dedicated Outside Air Ventilation Systems (DOAS)
The DSC will be served by a DOAS system. This system's purpose is to introduce outdoor air directly to interior rooms that do not have operable windows or permanent openings to exterior rooms, and to keep the building at a neutral pressure. The unit will be placed on the west end of the roof. Within the DOAS system is a total energy wheel. The wheel will precondition the air being introduced into the DSC by transferring energy from the exhaust air collected from the bathrooms, kitchenette, and workshop areas. The DOAS unit will include a heating section and a cooling section to slightly temper the air introduced into the building to 72 °F.

Exhaust Systems

The exhausts for the bathrooms, kitchenettes, and workshops will be ducted to one exhaust fan located within the DOAS unit. This exhaust fan will operate when any of the rooms it serves are occupied. The exhaust fan will also be interlocked with the dedicated outdoor air fan. Both fans will be required to run at the same time to keep the building at a neutral pressure. Additionally the fans will run when any interior offices served by the dedicated outdoor air fan are occupied.

Controls

All controls shall be DDC with electric actuation and PID loop control logic. Natural gas, heating hot water, and domestic cold water flow meters along with electric energy meters for receptacles, and interior and exterior lighting shall be provided to monitor and record overall building consumption and demand. Individual rooms shall have lighting occupancy sensors to control lighting. An auxiliary contact in the occupancy sensor will allow the VRF system's terminal unit to enter an unoccupied or occupied mode.
The DSC's interior office spaces and bathrooms will be served by the DOAS system. These rooms will contain occupancy sensors and will activate the DOAS system when any room is occupied. Temperature and humidity sensors will also be installed to sense outdoor conditions. When the outdoor conditions are appropriate operable windows will open promoting natural ventilation in the DSC.
The building will utilize a Building Management System (BMS) to control all the mechanical and electrical components and systems. All controls installed in the building shall utilize 'open' protocols such as BACnet or LONWORKS. Control diagrams and strategies will be addressed in the design development phase.

Energy Analysis

A schematic energy analysis was conducted on the DSC to understand its energy consumption. The program used to model the analysis was Trane Trace 700.
Below are the building envelope assumptions made for the baseline model and the proposed DSC model.

		Baseline Value		DSC Value	
		Assembly Maximum	Insulation Minimum R Value	Assembly Maximum	Insulation Minimum R Value
Roof	Insulation entirely above deck	U-0.048	R-20 CI	U-0.028571	R-20 CI
Walls	Mass	U-0.090	R-11.4 CI	U-0.03333	R-30 CI
Walls	Steel framed	U-0.064	R-13.0 + R-7.5CI	U-0.03333	R-X (as reqd.) + R15 CI
Fenstration	U - Vertical glazing-metal framing	U-0.45	-	U-0.45	-
Fenstration	SC - Vertical glazing-metal framing	SC - 0.45977	-	SC - 0.36	-
Fenstration	U - Vertical glazing - door	U-0.80		U-0.45	
Fenstration	SC - Vertical glazing - door	SC - 0.45977		SC - 0.36	
Skylight	U - W/ curb glass <2% roof area	U-1.17	-	U-0.45	-
Skylight	SC - W/ curb glass <2% roof area	SC - 0.563218	-	SC - 0.29	-
Slab On-Grade	Un-heated	U - 0.730	-	U - 0.730	-
Slab On-Grade	Heated	U - 0.860	R-15 for 24"	U - 0.860	R-15 for 24"

Further energy analysis data and assumptions can be found in Appendix 8.
It was found that the proposed design for the DSC is 27.5% less energy than the baseline building.

Plumbing Systems

Domestic Water System

Domestic water service shall be provided to the building from the city main into the building Mechanical Equipment Room by underground piping. Backflow prevention shall be provided per code requirements.
The systems selected for the domestic hot water needs for the building, including are solar heating and a heat pump type water heater. Both of the systems will be equipped with a recirculating line which will maintain 120°F the temperature will be reduced to the lavatories and sinks by a three way compensating mixing valve. The following tables show the sizing criteria used for determining the domestic hot water demand. (Calculations are based on ASHRAE 2007 HVAC Applications)
The total daily hot water consumption is estimated to be 1 GPM per person per day, totaling 200 gallons per day of hot water consumption.
Cold water hose bibs shall be installed in each large group restroom and mechanical room. Frost-proof hose bibs will be installed every 50 feet on the interior of the building.

Cold water hose bibs shall be installed in each large group restroom and mechanical room. Frost-proof hose bibs will be installed every 50 feet on the interior of the building.

Demand Factor			0.30
Storage Capacity Factor			2.00
Probable Maximum Demand			40 GPH
Storage Tank Capacity			80 Gal
Fixture Type	*Quantity*	*GPH/Fixture*	*Total GPH*
LAV (private)	5	2	10
LAV (public)	6	6	36
Kitchen Sink	1	20	20
Shower	2	30	60
Total			126

Sizing Based on Occupancy		
Occupancy	200	People
Recovery Capacity	0.30	GPH/Person
Usable Storage Capacity	0.30	Gal/Person
Percentage of Usable Hot Water in Tank	90%	(Typically 60-80% can be as high as 90%)
Minimum Recovery Rate	60	GPH
Tank Size	67	Gal

Sanitary and Storm Water System
Sanitary and storm connections shall be made as required to existing city mains. It is anticipated that storm / sewage ejection pumps will not be required. There will be two separate sanitary systems. One will connect to all the water closets, urinals, floor drains and the kitchen sink and discharge to the city main. The other system will connect to the lavatories and shower and connect to a greywater reuse system *(See Greywater Reuse section for more details)*. The storm water will be addressed by the site engineers.
Shower rooms, mechanical rooms and both public restrooms shall have floor drains installed.

Greywater reuse
A Water Legacy WL-55 Greywater Recycling System shall be provided to minimize water usage. The following will explain the system setup and the savings achieved.
Sanitary piping serving the lavatories, and showers shall be piped separately back to the WL-55 storage tank. Rain water can also be piped back to this unit. The water will go through a dual hydrogen peroxide and UV light disinfection process. The water will then be filtered and pumped from the storage tank to the water closets and urinals throughout the building. The tank will also include a make-up water line in order to verify that there is always enough water in the system.
The greywater system does not include chlorine to help promote a safer working environment by eliminating the handling of the toxic chemical.
The following table shows the amount of water used by the lavatories and showers along with the necessary water required for the water closets and urinals. *(Calculations are based on the 2006 National Standard Plumbing Code)*

Fixture	Quantity	WSFU	Total WSFU's	Total GPM
Lavatories	11	6.4	9.4	26
Showers	2	3		
Fixture	Quantity	WSFU	Total WSFU's	Total GPM
Water Closet	9	22.5	30.5	20
Urinals	2	8		

WSFU = Water Supply Fixture Units

As the table illustrates the amount of waste water from the lavatories and the showers is enough to accommodate the water needs of the water closets and urinals. Without this system the total cold water usage would be around 46 GPM, and with the system the total cold water usage would be 26 GPM. Implementing this system will generate a 45% reduction in water usage for the building.

Water Consumption Reduction
Plumbing fixtures are reduced flow energy conservation as required by Energy Policy Act of 1992. Reduced flow plumbing fixtures shall be considered, including 1.28 gallons per flush (gpf) water closets or dual flush and 0.125 gpf urinals to meet the requirements of LEED credit WE 3.1. Sensor operated or metering faucets will be used at all lavatories. All fixtures will comply with EPA water sense fixtures.

HVAC & Plumbing Equipment List

Equipment	Space Required	Location
VRF heating and cooling system (2)	L 60" x W 60" x H 72"	Mezzanine
Geothermal heat exchanger	L 48" x W 23" x H 70"	Mezzanine
Geothermal wells	As final design requires	Site
Geothermal water pumps (2)	L 48" x W 48" x H 48"	Mezzanine
Condensing boilers for auxiliary radiant heat	L 60" x W 60" x H 60"	Mezzanine
Hydronic pumps (2)	L 48" x W 48" x H 48"	Mezzanine
A dedicated outdoor air unit	L 120" x W 65" x H 68"	Roof
Energy recovery wheel	Located within DOAS	
Exhaust fan	Located within DOAS	
Outdoor air supply fan	Located within DOAS	
A solar water heater	29" Diameter x 63" Height	Mezzanine
	80" x 45" Panels (5)	Roof
A heat pump water heater	25" Diameter x 82" Height	Mezzanine
Grey water reuse	26" Diameter x 65" Height	Basement
Thermal storage tank	72” Diameter x 72” Height	

Note: Equipment clearances are not included in the above space requirements.

Mechanical Specifications

230513 - Common Motor Requirements for HVAC Equipment
230516 - Expansion Fittings and Loops for HVAC Piping
230517 - Sleeves and Sleeve Seals for HVAC Piping
230518 - Escutcheons for HVAC Piping
230519 - Meters and Gages for HVAC Piping
230523 - General-Duty Valves for HVAC Piping
230529 - Hangers and Supports for HVAC Piping and Equipment
230553 - Identification for HVAC Piping and Equipment
230593 - Testing, Adjusting, and Balancing For HVAC
230713 - Duct Insulation
230716 - HVAC Equipment Insulation
230719 - HVAC Piping Insulation
230800 - Commissioning Of HVAC
230900 - Instrumentation and Control for HVAC
230993 - Sequence of Operations for HVAC Controls
231123 - Facility Natural-Gas Piping
232113 - Hydronic Piping
232123 - Hydronic Pumps
233113 - Metal Ducts
233300 - Air Duct Accessories
233600 - Air Terminal Units
233713 - Diffusers, Registers, and Grilles
234100 - Particulate Air Filtration
235216 - Condensing Boilers
236200 - Packaged Compressor and Condenser Units
237200 - Air-To-Air Energy Recovery Equipment
237433 - Dedicated Outdoor-Air Units
238146 - Water-Source Unitary Heat Pumps
238239 - Unit Heaters
238316 - Radiant-Heating Hydronic Piping
23211333 - Ground-Loop Heat-Pump Piping
23561313 - Heating, Flat-Plate, Solar Collectors

23561319 - Heating, Solar, Vacuum-Tube Collectors

Plumbing Specifications
220513 - Common Motor Requirements for Plumbing Equipment
220516 - Expansion Fittings and Loops for Plumbing Piping
220517 - Sleeves and Sleeve Seals for Plumbing Piping
220518 - Escutcheons for Plumbing Piping
220519 - Meters and Gages for Plumbing Piping
220523 - General-Duty Valves for Plumbing Piping
220529 - Hangers and Supports for Plumbing Piping and Equipment
220553 - Identification for Plumbing Piping and Equipment
220716 - Plumbing Equipment Insulation
220719 - Plumbing Piping Insulation
221116 - Domestic Water Piping
221119 - Domestic Water Piping Specialties
221313 - Facility Sanitary Sewers
221316 - Sanitary Waste and Vent Piping
221319 - Sanitary Waste Piping Specialties
221413 - Facility Storm Drainage Piping
221423 - Storm Drainage Piping Specialties
221513 - General-Service Compressed-Air Piping
221519 - General-Service Packaged Air Compressors and Receivers
223300 - Electric, Domestic-Water Heaters
223500 - Domestic-Water Heat Exchangers
224223 - Commercial Showers, Receptors, and Basins
224500 - Emergency Plumbing Fixtures
224713 - Drinking Fountains
2242131 - Commercial Water Closets
22421316 - Commercial Urinals
22421613 - Commercial Lavatories
22421616 - Commercial Sinks

Electrical Systems

Lighting Control Systems

Occupancy sensors will be utilized throughout the facility except for the wood shop areas and the mechanical rooms for personnel safety. Smaller utility rooms will be equipped with switch mounted timer units. Daylight harvesting is intended for areas where natural lighting is available with ambient lighting controls. The ambient lighting sensors will appropriately dim or completely turn off the artificial fluorescent lighting when adequate natural lighting is available. Dimming ballasts will be provided for fluorescent fixtures for dimming. LED lighting will be dimmed with compatible dimmers, where applicable. The wood shop areas and mechanical rooms will be equipped with switching to shut down lighting per area or task. Task lighting at desks will be LED type, switchable and preferably switched via integral motion sensor or be provided and switched via cubicle power control system. [Note: task lighting is typically provided by the owner if not attached to building or manufactured furniture systems.] Other interior building lighting and site lighting will be connected to a building low voltage lighting control system to turn off all non-emergency lighting per an owner prescribed building operation schedule. Specific space override controls as part of the low voltage lighting control system will be provided to allow lighting to be turned on per space for a maximum of four hours.

The building mounted exterior and site lighting will be provided with on-board occupancy sensors that will lower the lighting level to half output when there is no motion is sensed in the area generally served by the lighting fixture after a fixed time delay. Site and building mounted exterior lighting can be connected to the low voltage lighting control system or can be controlled by photocell control if all night dusk to dawn security lighting is required.

Lighting Fixture Types

Direct/indirect pendant fluorescent lighting will be utilized in open areas. Direct fluorescent lighting with high reflectivity reflectors or industrial fluorescent lighting fixtures will be used in utility areas. For areas with lower lay in ceilings, recessed fluorescent fixtures with high efficiency electronic ballasts will be used. LED downlighting will be utilized where required and as applicable. LED wall wash lighting may also be specified in the café area to provide highlighting of menu boards, displays, etc. High bay industrial lighting will be pulse start metal halide technologies or high bay fluorescent fixtures, however, LED high bay lighting may be specified in high bay applications as applicable and/or budget allows.

Building mounted lighting exterior lighting will be LED type. Pole mounted parking lot and site lighting will be LED type.

Exit signage will be LED type with integral battery backup. Emergency lighting will be provided via integral fluorescent battery packs and halogen individual emergency battery units.

Power Distribution Systems

Power will be provided via an overhead service, 208/120 volt three phase 4 wire from the nearby DTE Energy overhead lines. The incoming service panelboard rating will be 208/120 volt, three phase, four wire, 600 amperes. Distribution of power will be via 208/120 volt panelboards throughout the facility.

Generally, duplex receptacles will be provided throughout the building. Receptacles within cubicles for non-CPU circuits can be switched via manufactured furniture cubicle motion sensor control system at each desk; this is an option that would need to be specified with the furniture system. Special receptacles will be provided for specialty equipment within the building, specifically within the Wood Shop and the Cafe Areas. Ground Fault Circuit Interrupter type duplex receptacles will be provided for 20 ampere, 120 volt receptacles located within 6 feet of sinks, near overhead doors, and where located outdoors. 208 volt three phase power will be provided to the elevator and larger motors.

Branch circuits and feeders will be routed in metal conduits. Minimum conduit size will be 3/4” diameter. All wiring will be copper with THHN/THWN insulation. Minimum wire size for all power wiring including branch circuits will be #12 awg.

Grounding will be provided via exterior ground rods, a ground bus at the service entrance panelboard location, with connections to the incoming water pipe and building steel. All branch circuits will be provided with a separate grounding conductor

Power Systems (Generation)

Power Generation – Photo Voltaic
Renewable Energy Solutions will be provided for the renovated building. The three technologies that are being proposed are Thin Film Photovoltaic materials for portions of the roof area, Crystalline Photovoltaic panels would be proposed for exterior wall mounting or on a structure on grade, and small Wind Turbine system all connected directly into the utility AC system complete with inverters utility net metering, etc.
The Photovoltaic system equipment will generally provide 12 watts/sf of photovoltaic panel being provided. (Results vary slightly with manufacturer provided.) The installed costs generally are $8-10 per watt of photovoltaic panel. The systems typically provide approximately 1kwh/1watt of photovoltaic panel/yr. To possibly obtain maximum contribution from DTE Energy via their Solar Currents program, the maximum rating of the entire Photovoltaic system will be 20KW (or less).

Power Generation - Wind
The Wind Turbine system to be a reasonable scale for a site such as this is approximately 1.0-1.2KW. By reasonable scale, the installed costs for a system of this rating is approximately $7-10/w for most systems installed including a 30 foot tower, inverter, base, and wiring all installed.

Power Monitoring and Controls
Customer metering (non-utility) metering will be provided at key locations in the distribution system to allow tracking and analyzing power usage within the facility. Additional metering data points can be added to provide data to the facility managers most likely via the building management system provided by the mechanical trades. With proper extraction and processing, the information can be electronically extracted and displayed for public consumption if desired. Public display such as KWH of power being generated per day, per week, per year, instantaneous KW of power being generated, etc. This would require some programming and a custom built display.

Daylighting Analysis

A daylighting analysis was conducted on the DSC. The amount of daylight entering the building during business hours was analyzed throughout a one year period. It was found that much of the building is adequately light for office and shop use. The analysis took into consideration the geometry of the building, the operating hours of Detroiters Working for Environmental Justice, and the window construction.
Figure 9 shows the results of the analysis. Light is measured in lumens. 30 lumens were necessary for the building to be light using daylighting. The yellow areas on Figure 9 are at 63 lumens, the red areas are at 31.5 lumens, and the blue areas are at 0 lumens.
Recent updates to the design have added clerestories to the south west shop area which is currently blue in Figure 9. Clerestories are elevated windows which allow greater light penetration into a space.

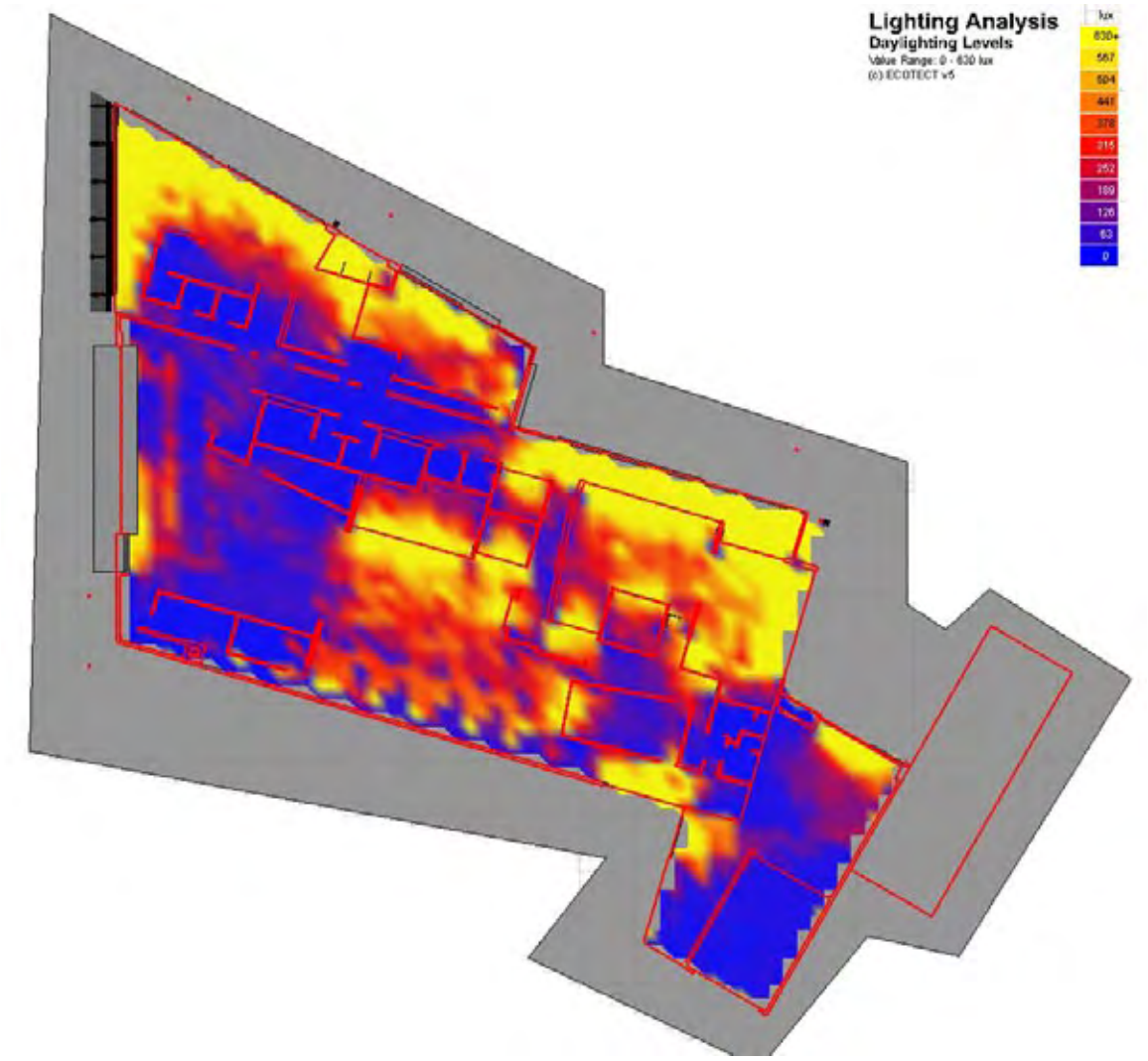


Figure 9 Daylighting Study

ELECTRICAL SPECIFICATIONS

16000 Electrical - Notice
16050 Basic Materials and Methods
16060 Grounding
16070 Supporting Devices and Vibration Isolation
16071 Electrical Seismic Control
16120 Wires and Cables, 600 Volts and Below
16126 Wire Connection and Devices
16130 Conduit
16132 Boxes
16140 Wiring Devices
16316 Underground Power Distribution
16410 Enclosed Switches and Circuit Breakers
16420 Motor Starters
16442 Panelboards
16491 Fuses
16501 Lamps

16502 Ballasts and Accessories
16503 Poles and Standards
16535 Emergency Lighting Units
16571 Programmable Lighting Control Systems
16721 Fire Alarm and Detection System
16920 Mechanical Equipment Controls
16950 Electric Heating Cables
16980 Photovoltaic System
16981 Wind Turbine System
16995 Commissioning of Electrical Systems

Appendix
Appendix 1

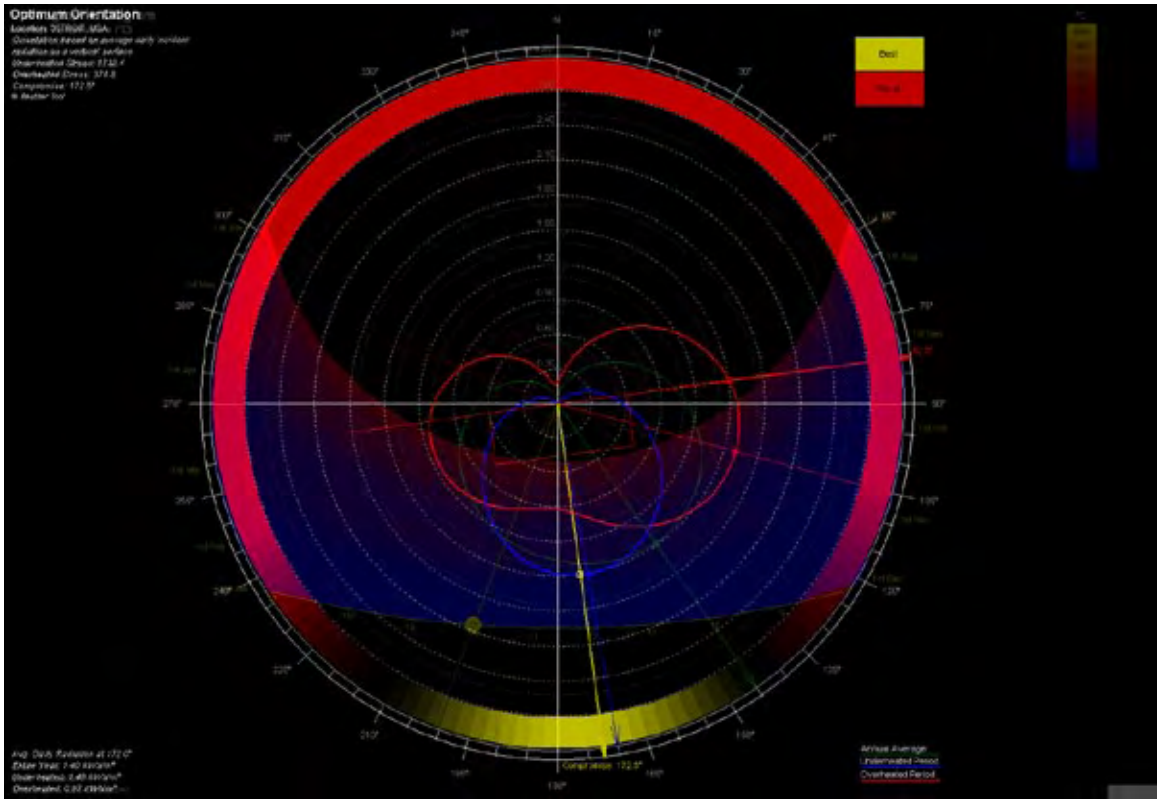


Figure 10 - DSC Orientation & Optimal Orientation

Figure 10 above is the results of a building orientation analysis. The optimal orientation of a building located on the DSC's site would be 172.5° clockwise from north. This optimal orientation is derived from the weather information for Detroit. The rotation of a building is calculated to optimize free cooling in the summer time and free heating in the winter time. The actual orientation of the DSC is approximately 202° clockwise from north. As can be seen from the above analysis this position is still oriented in the yellow, or desirable region.

Appendix 2

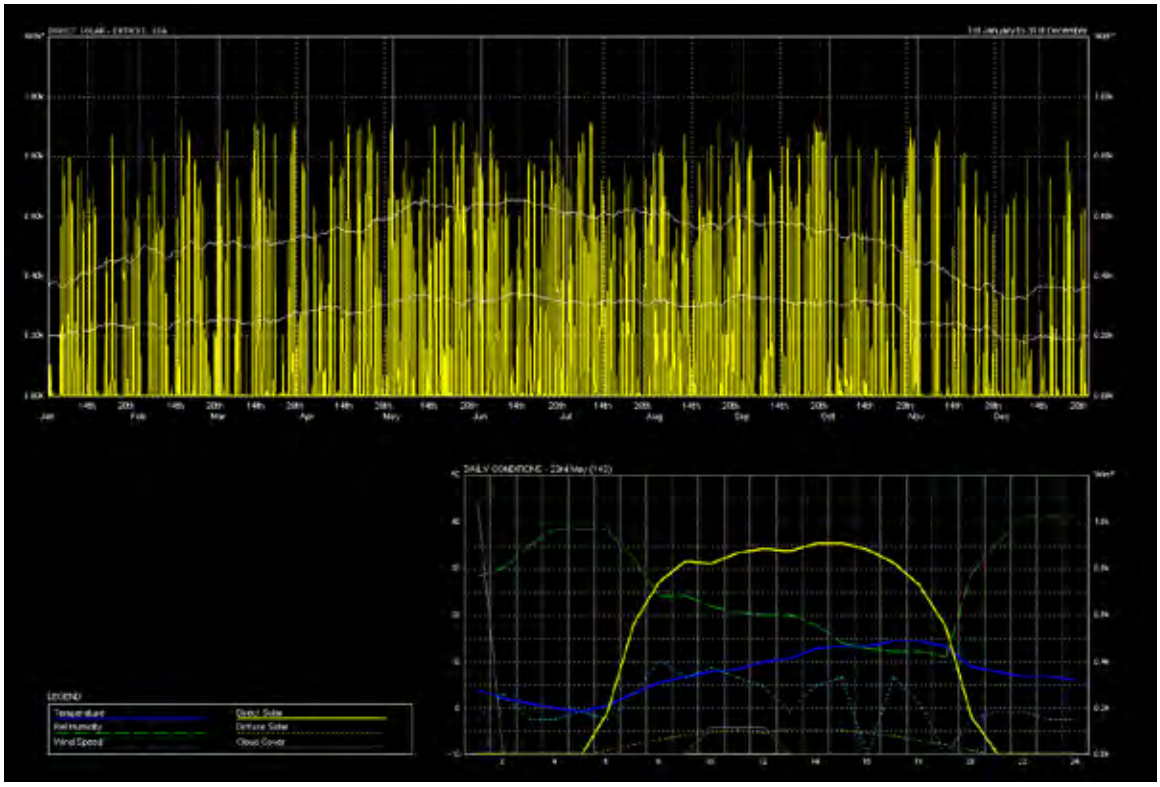


Figure 11 - Direct Radiation & Brightest Day

Figure 11 above is a graph of the direct solar radiation the DSC will receive. The yellow spikes in the above graph indicate the solar radiation throughout a typical year. The smaller graph in the bottom right is the direct solar radiation received by the DSC on the brightest day in Detroit. The graph shows the solar radiation starting near 5AM and ending near 9 PM. The average amount of radiation received through the day is above 800 W/m2.

Appendix 3

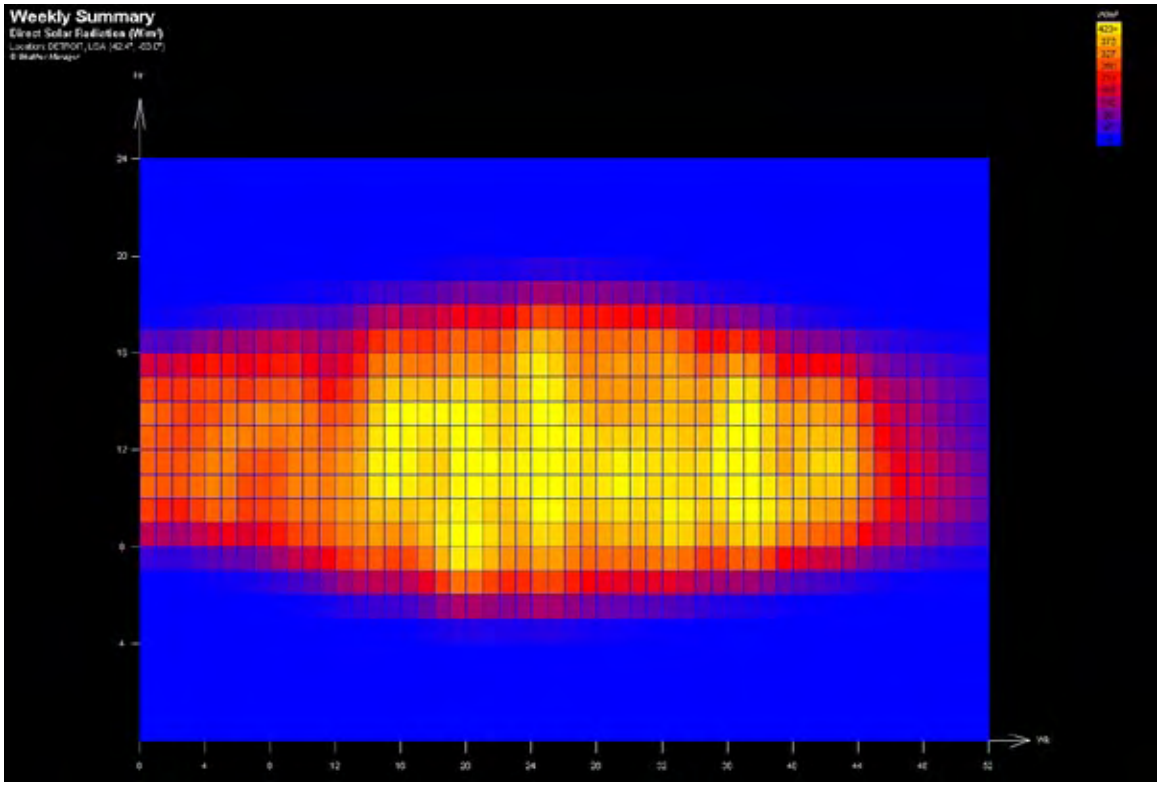


Figure 12 - Solar Radiation - Hours - Weeks

Figure 12 above depicts the solar radiation the DSC will receive throughout the day for a typical year. The Y-axis in the above figure are hours of the day, with 1 AM being near the bottom of the graph. The X-axis is the weeks of the year, with the first week of the year beginning at the left side of the graph. It can be noted that the greatest amount of solar radiation is received in the middle of the year when the days are the longest. The amount of solar radiation drops off at beginning and ending weeks, which correspond to the winter and the shortest days of the year.

Appendix 4

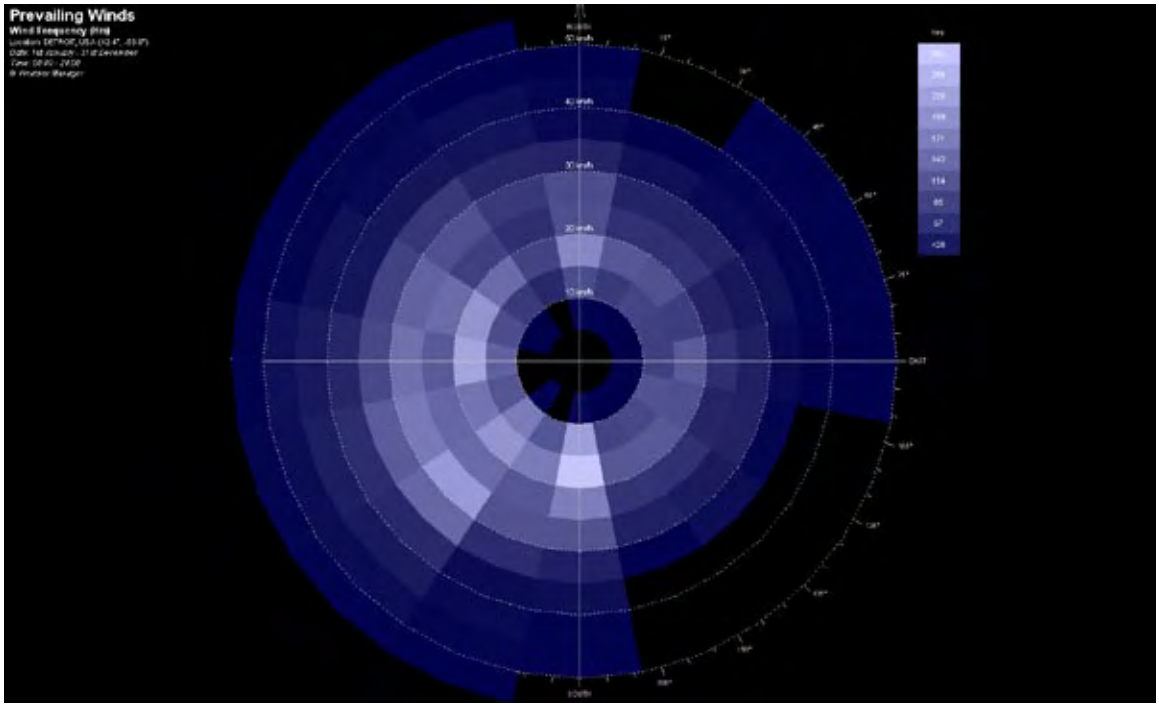


Figure 13 - Wind Frequency, Direction, and Speed at the DSC

Figure 13 is a prevailing winds diagram. This diagram is a polar chart which describes wind speed by the distance out from the center of the chart, wind direction by the angle relative to the top of the chart (which is north), and wind frequency by the color of the cells. The lighter the color of a cell the more hours of wind the DSC receives at the speed and from that direction. The diagram shows that the DSC receives a significant amount of wind between 6 MPH and 22 MPH (10 km/h and 35 km/h). Also the diagram shows that the majority of the wind at all velocities is out of the west.

Appendix 5

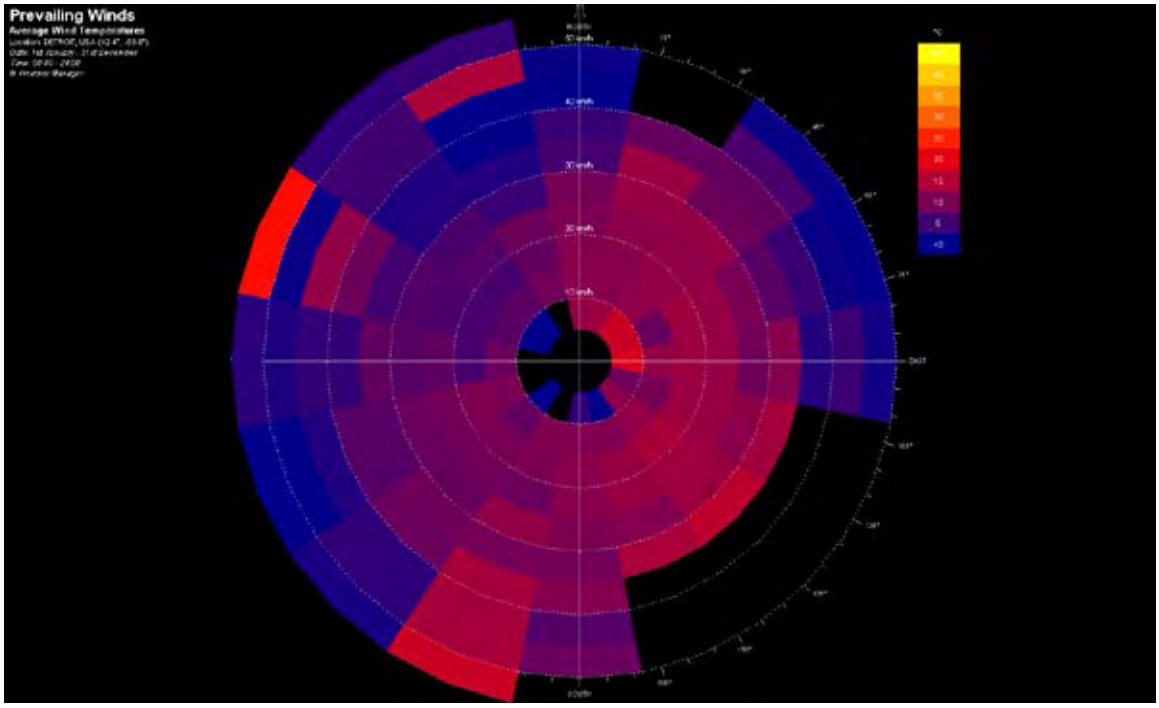


Figure 14 - Wind Temperature, Direction, and Speed at the DSC

Figure 14 is very similar to Figure 13. The only variable that has been changed between these two prevailing winds diagrams is that wind frequency from Figure 13 has been substituted for wind temperature in Figure 14.

Appendix 6

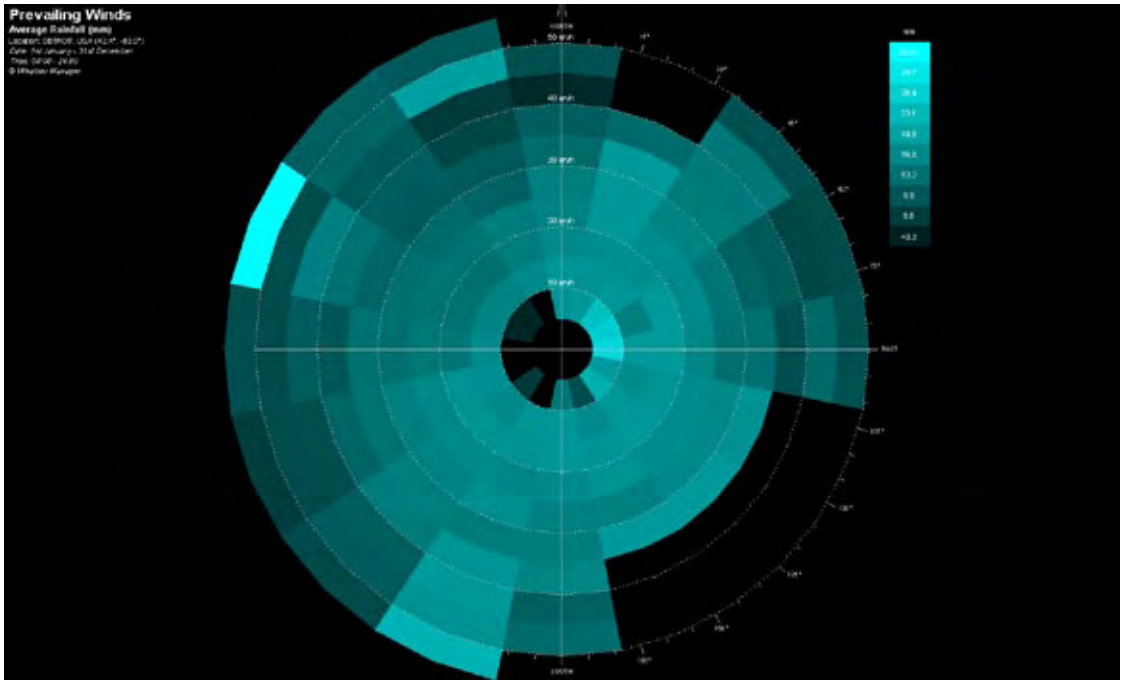


Figure 15 - Wind and Rainfall, Direction, and Frequency at the DSC

Figure 15 is very similar to Figure 13. The only variable that has been changed between these two prevailing winds diagrams is that wind frequency from Figure 13 has been substituted for rain fall amounts in Figure 14. The diagram shows that the majority of rain is received from the west.

Appendix 7

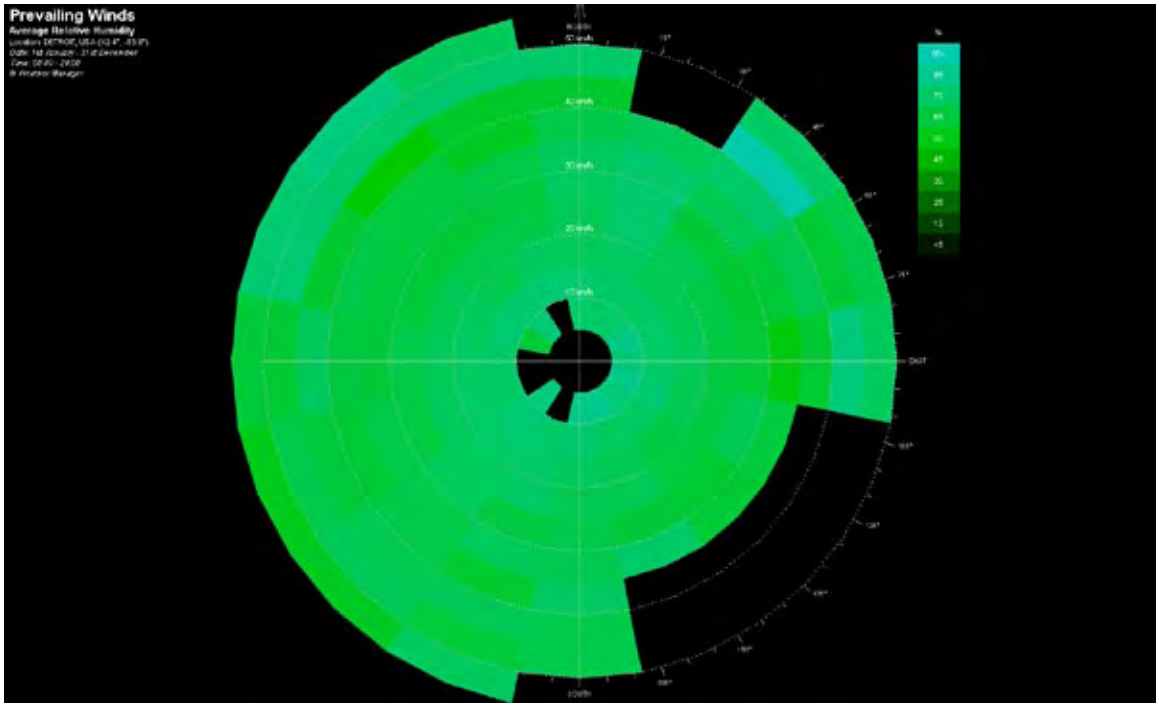


Figure 16 - Wind and Humidity, Direction and Frequency at the DSC

Figure 16 is very similar to Figure 13. The only variable that has been changed between these two prevailing winds diagrams is that wind frequency from Figure 13 has been substituted for humidity amounts in Figure 16.

Appendix 8

Yellow = Exhausted

Room #	Room Name	Area	Interior (I) / Perimeter (P) Room	Natural Ventilation Requirments: Natural Ventilation Operable Window Area (Sq Ft) Requirmen	Natural Ventilation Operable Window Area (Sq Ft) Current	Interior Room's Adjacent Perimeter Room	Interior Room Required to 25 sq ft OpeningBetween Rooms	Occupancy Schedule	Maximum Occupancy	# of Computers	Miscellaneous Equipment	Ceiling Height A.F.F.)
101	Woodshop | Workspace	1802	P	72.08	72.75			8AM-5PM	32	0	4 HP heat from inefficiencies of motors.	
102	Corridor	926	P	37.04	56.22			8AM-5PM		0		
103	PM Office |Job Developer	317	I	Need Perm. Opening To Adj Rm		102	Y	8AM-5PM	3	1		10'-0"
104	Bathroom	144	I	Need Perm. Opening To Adj Rm		101	Y	8AM-5PM		0		8'-0"
105	Corridor	673	I	Need Perm. Opening To Adj Rm		109 & 110	Y	8AM-5PM		0		
106	PM Office	132	I	Need Perm. Opening To Adj Rm		110	Y	8AM-5PM	2	1		8'-0"
107	Classroom	638	P	25.52	35 (above)			8AM-5PM	10	1		10'-0"
108	Classroom	703	P	28.12	28			8AM-5PM	30	1		10'-0"
109	Corridor	575	P	23	35.77			8AM-5PM		0		
110	Model Home Lab	1457	P	58.28	56.22 + 50.64 (above)			8AM-5PM	8	1	4 HP heat from inefficiencies of motors.	
111	Office	93	I	Need Perm. Opening To Adj Rm		110	Y	8AM-5PM	2	1		8'-0"
112	Office	103	I	Need Perm. Opening To Adj Rm		102	Y	8AM-5PM	2	1		8'-0"
113	Elect/Network	49	I	Need Perm. Opening To Adj Rm		121	Y	8AM-5PM		0	800 W	8'-0"
114	PM Office | TA Hotline	318	I	Need Perm. Opening To Adj Rm		110	Y	8AM-5PM	4	1		10'-0"
115	Bathroom	353	I	Need Perm. Opening To Adj Rm		117	Y	8AM-5PM		0		8'-0"
116	Media | Audio Visual Storage	157	I	Need Perm. Opening To Adj Rm		117	Y	8AM-5PM		0		8'-0"
117	Event Space | Public Exhibition	2095	P	83.8	12.66 (above)			8AM-5PM	125	1		
118	Storage	132	I	Need Perm. Opening To Adj Rm		102	Y	8AM-5PM	1	0		10'-0"
119	Event Space | Public Exhibition	516	P	20.64	93.66			8AM-5PM		1		
120	Storage	33	I	Need Perm. Opening To Adj Rm		121	Y	8AM-5PM		0		
121	Administration	662	P	26.48	27.16			8AM-5PM	15	1		
122	Entry	100	P	4	6.6			8AM-5PM		0		
123	Green Cafe - Seating	963	P	38.52	26.56			8AM-5PM	47	0		
124	Green Cafe - Seating-P	297	P	11.88	30.39			8AM-5PM		0		
125	Green Cafe - Seating-P	223	P	8.92	13.42			8AM-5PM		0		
126	Green Cafe - Kitchnette	213	I	Need Perm. Opening To Adj Rm		123	Y	8AM-5PM	2	0	Coffee brewing urn, small freezer, rapid cook oven (microwave), reach in refrigerator.	
127	Bathroom	90	I	Need Perm. Opening To Adj Rm		123	Y	8AM-5PM		0		
128	Storage	46	I	Need Perm. Opening To Adj Rm		125	Y	8AM-5PM		0		
				Need Perm. Opening To Adj Rm				8AM-5PM				
201	Office	229	P	9.16	17.72			8AM-5PM		1		
202	Office	173	P	6.92	11.94			8AM-5PM		1		
203	Boardroom	376	P	15.04	15.36			8AM-5PM		1		
204	Corridor and Office	680	P	27.2	27			8AM-5PM	8	1		
205	Bathroom	49	I	Need Perm. Opening To Adj Rm		204	Y	8AM-5PM		0		
206	Mechanical Space	758	I	Need Perm. Opening To Adj Rm		110	Y	8AM-5PM		0	2 Tons of cooling.	
Totals		16075		496.6	617.07				291	15		

Total Window Area Required: 643

Figure 17 - Energy Analysis Data

Figure 17 is a table with data used for the energy analysis for the DSC.

Appendix 9
Programming Data

Detroit Sustainability Center (DSC)

inFORM studio
Conservation Design Forum
URS Corporation

Program Requirements and Sizes
December, 2010

DSC.1 **Executive (Upper Floor)** **Scheme 'A'**

Usage: Office space for Excecutive Staff of the Detroit Sustainability Center
Occupancy Classification: **B** (Business)

Number	Name	Req'd	Size	Total Area	
DSC.1.1	**Executive Director**	1	275	1056	Open Office - Combining DSC1.1 - D
DSC.1.2	**Deputy Director**	1	275	n/a	
DSC.1.3	**Communications|Outreach**	1	150	n/a	
DSC.1.4	**Human Resources**	1	275	n/a	
DSC.1.5	**Property Management**	1	150	n/a	
DSC.1.6	**Finance Manager**	1	275	n/a	
DSC.1.7	**Board Room**	1	500	191	Small meeting room
DSC.1.8	**Kitchnette**	1	125	50	
			SQ.FT.	**1,297**	**SQ.FT.**

DSC.2 **Administrative** **Scheme 'A'**

Usage: Office space for Administrative Staff of the Detroit Sustainability Center
Occupancy Classification: **B** (Business)

Number	Name	Req'd	Size	Total Area	
DSC.2.1	**Reception|Administration**	1	200	204	Includes copy/fax area and storage
DSC.2.2	**Public Waiting Area**	n/a	n/a	124	
DSC.2.3	**Flexible Team Work Area**	n/a	n/a	639	
			SQ.FT.	**967**	**SQ.FT.**

DSC.3 **Information Technology** **Scheme 'A'**

Usage: Office and storage space for IT Staff of the Detroit Sustainability Center
Occupancy Classification: **B** (Business)

Number	Name	Req'd	Size	Total Area	
DSC.3.1	**IT Manager**	1	125	115	
DSC.3.2	**Media|Audio Visual Storage Room**	1	150	145	
			SQ.FT.	**260**	**SQ.FT.**

DSC.4 **Youth on Patrol Against Pollution (YOPAP)** **Scheme 'A'**

Usage: Lab & Classroom space to support YOPAP program
Occupancy Classification: **B** (Business)

Number	Name	Req'd	Size	Total Area	
DSC.4.1	**Program Manager Office**	1	150	120	
DSC.4.2	**Classroom**	1	870	573	Sliding partition opens to provide sing
DSC.4.4	**Learning Lab**	1	630		1000 +/- sq.ft. provided at building ex
			SQ.FT.	**693**	**SQ.FT.**

DSC.5 **Green Jobs Training** **Scheme 'A'**

Usage: Training & Classroom space to support Green Jobs program
Occupancy Classification: **B** (Business) | **F1** (Factory Industrial)

Number	Name		Req'd	Size	Total Area	
DSC.5.1	**Program Manager Office**		1	150	326	Open Office - Combining PM / Job De
DSC.5.2	**Job Developer|Assistant**		1	250	n/a	
DSC.5.3	**Counseling Center**		2	185	193	Single room - can build in an option to
DSC.5.4	**Training Center**					
	DSC.5.4.1	Model Home Lab	1	500	1,154	Adjacent sliding doors open to Event
	DSC.5.4.2	Workspace Storage	1	250	378	
	DSC.5.4.3	Woodshop|Workspace	1	2,600	1,370	

DSC.7	Community | Common					Scheme 'A'	
Usage:	flexible gallery space with ability to be secured from community						
Occupancy Classification:	**A1 & A2** (Assembly)						
	Number	**Name**		**Req'd**	**Size**	**Total Area**	
	DSC.7.1	**Public Education|Exhibit|Event Space**		1	3,450	2,466	Adjacent sliding doors open to Model
	DSC.7.2	**Resource Library**		1	384	194	
	DSC.7.3	**Tech Booth**		1	125	56	
	DSC.7.4	**Green Café**					
		DSC.7.4.1	Café Seating	1	700	722	
		DSC.7.4.2	Kitchenette / wet area	1	150	253	Includes Storage Room
					SQ.FT.	**3691**	**SQ.FT.**

DSC.8	Ancillary | Support					Scheme 'A'	
Usage:	support services for Detroit Studio						
	Number	**Name**		**Req'd**	**Size**	**Total Area**	
	DSC.8.1	**Shipping | Receiving**		1		371	
	DSC.8.2	**Mechanical Room**		1	1,448	989	Includes 343 sq.ft. basement & 636 sc
	DSC.8.3	**Toilet Rooms**					
		DSC.8.3.1	Cafe Men's Room	1	42	43	
		DSC.8.3.2	Cafe Women's Room	1	42	43	
		DSC.8.3.3	Public Men's Room	1	150	159	
		DSC.8.3.4	Public Women's Room	1	150	165	
		DSC.8.3.5	Administration Toilet Room	1	80	49	2 Single Occupancy - ADA
		DSC.8.3.6	Program Toilet Room - Men	1	75	66	includes shower
		DSC.8.3.7	Program Toilet Room - Women	1	75	75	includes shower
	DS.8.4	**Circulation**	General Building Circulation	1	2,915	3095	Includes Corridors / Exhibit Kiosk / Ele
					SQ.FT.	**5055**	**SQ.FT.**

Appendix 10
LEED Evaluation

Detroiters Working for Environmental Justice (DWEJ)
Project Overview

The Detroit Sustainability Center
LEED® 2009 for New Construction & Major Renovations
Overall Summary

Sustainable Sites

Points Available	26
DSC Potential Points Achieved	26

Water Efficiency

Points Available	10
DSC Potential Points Achieved	10

Energy and Atmosphere

Points Available	35
DSC Potential Points Achieved	20

Materials and Resources

Points Available	14
DSC Potential Points Achieved	8

Environmental Quality

Points Available	15
DSC Potential Points Achieved	14

Innovation and Design Process

Points Available	6
DSC Potential Points Achieved	6

Regional Priority Credits

Points Available	4
DSC Potential Points Achieved	4

Detroit Sustainability Center
LEED Point Summary

Total Points Available	110	
DSC Potential Points Achieved	88	Platinum Rating

LEED® 2009 for New Construction & Major Renovations
Sustainable Sites

Points Available 26
DSC Potential Points Achieved 26

Many of the credits in Sustainable Sites have very low cost impacts. The credits tend to be either readily achievable at little cost, or impractical for a given project. Some credits are more suited to urban locations, others to more open locations. In many cases, the driver for these credits is the degree of urbanization. The first four points have to do with site selection, urban density, Brownfield reclamation, and proximity to mass transit.

Project Checklist

Y	?	N	Sustainable Sites		Possible Points: 26
Y			Prereq 1	Construction Activity Pollution Prevention	
			Credit 1	Site Selection	1
			Credit 2	Development Density and Community Connectivity	5
			Credit 3	Brownfield Redevelopment	1
			Credit 4.1	Alternative Transportation—Public Transportation Access	6
			Credit 4.2	Alternative Transportation—Bicycle Storage and Changing Rooms	1
			Credit 4.3	Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles	3
			Credit 4.4	Alternative Transportation—Parking Capacity	2
			Credit 5.1	Site Development—Protect or Restore Habitat	1
			Credit 5.2	Site Development—Maximize Open Space	1
			Credit 6.1	Stormwater Design—Quantity Control	1
			Credit 6.2	Stormwater Design—Quality Control	1
			Credit 7.1	Heat Island Effect—Non-roof	1
			Credit 7.2	Heat Island Effect—Roof	1
			Credit 8	Light Pollution Reduction	1

SS Prerequisite 1: Construction Activity Pollution Prevention
(Required)

Intent
In order to comply, it is necessary to develop a compliant site sedimentation and erosion control plan. These plans are mandatory in many parts of the country. Compliance with this credit is generally within customary practices for design and construction teams.

- Cost impact: In most cases, this credit has no construction or soft cost impact. The standards and technologies required for this point are standard to most projects; if not, they are achieved at minimal added cost. The credit can generate a very small reduction in overall construction costs by reducing cleanup and corrective action which would otherwise arise following significant storm events.
- Practical Applications: To meet the requirements of this prerequisite, an Erosion Control Plan must be developed that addresses all of the following components:
    - A statement of erosion and stormwater control objectives
    - A comparison of post-development stormwater runoff conditions with predevelopment conditions
    - A description of all temporary and permanent erosion control and stormwater control measures implemented on the project site
    - A description of the type and frequency of maintenance activities that will be required for the erosion control measures utilized.

Potential Technologies, Strategies & Goals
- Create an erosion and sedimentation control plan during the design phase of the project.
- Consider employing strategies such as;
    - Temporary and permanent seeding, mulching
    - Buffer Zones or Vegetated Filter Strips
    - Diversion Ditches
    - Silt fencing
    - Sediment traps
    - Sediment basins
    - Stabilized Construction Entrances

SS 1: Site Selection

Points Available 1
DSC Potential Points Achieved 1

Intent

Avoid development of inappropriate sites and reduce the environmental impact from the location of a building on a site. Intent met by utilization of an existing building.

Requirement

Do not develop buildings, roads or parking areas on portions of sites that meet any one of the following criteria:

- Prime farmland as defined by the United States Department of Agriculture.
- Land whose elevation is lower than 5 feet above the elevation of the 100-year flood.
- Land which is specifically identified as habitat for any species on Federal or State threatened or endangered lists.
- Within 100 feet of any water including wetlands.
- Land which prior to acquisition for the project was public parkland.

Feasibility

Most site selection is driven by a wide range of factors, and appropriateness of site is usually a result, not a driver, of the site selection. Typically, there are no construction or soft costs associated with the credit, since there is no mitigation other than avoiding non-compliant sites. However, choice of location can affect feasibility and cost of sustainable design measures, and thus overall project costs.

- Cost impact: Possible costs would be related to land value where appropriate sites are available at an added cost.

Potential Technologies, Strategies & Goals

During the site selection process, give preference to sites that do not include;

- sensitive elements
- restrictive land types

Select a suitable building location and design the building with a minimal footprint to minimize disruption of the environmentally sensitive areas identified above.

SS 2: Development Density and Community Connectivity

Points Available 5
DSC Potential Points Achieved 5

Intent

Channel development to urban areas with existing infrastructure, protect greenfields, and preserve habitat and natural resources.

Requirement

Increase localized density to conform to existing or desired density goals by utilizing sites that are located within an existing minimum development density of 60,000 square feet per acre (two-story downtown development); or construct or renovate a building on a site that meets the following criteria:

1. Is located on a previously developed site
2. Is within 1/2 mile of a residential area or neighborhood with an average density of 10 units per acre net
3. Is within 1/2 mile of at least 10 basic services
4. Has pedestrian access between the building and the services

Feasibility

As with SS 1, this credit is usually a result, rather than a driver, of site selection, and credit compliance is a consequence of other factors. The credit is suited to this urban project, where the site happens to comply either because of density or proximity to amenities.

Potential Technologies, Strategies & Goals

The selected site gives preference in an urban setting with pedestrian access to a variety of services.

Services provided within ½ mile:

1) Bank
2) Place of Worship
3) Convenience Grocery
4) Day Care
5) Cleaners
6) Fire Station (1.25 miles)
7) Beauty
8) Hardware (1.8 miles)
9) Laundry
10) Library
11) Medical/Dental
12) Senior Care Facility
13) Park
14) Pharmacy
15) Post Office
16) Restaurant
17) School
18) Supermarket
19) Theater (3.3 miles)
20) Community Center
21) Fitness Center (0.7 mile)
22) Museum (Museum District – 4.0 miles)

SS 3: Brownfield Redevelopment

Points Available 1
DSC Potential Points Achieved 1

Intent

Rehabilitate damaged sites where development is complicated by real or perceived environmental contamination, reducing pressure on undeveloped land.

Requirement

Develop on a site documented as contaminated (by means of an ASTM E1903–97 Phase II Environmental Site Assessment) *or* on a site classified as a brownfield by a local, state, or federal government agency. Effectively remediate site contamination.

Feasibility

This credit is usually a result, rather than a driver, of site selection, and credit compliance is a consequence of other factors. This credit is achieved either by soils remediation, or removal/ abatement of asbestos or other hazardous materials from an existing facility (to be renovated or demolished). There are a variety of strategies for mitigating soils contamination, including encapsulation, remediation, etc. These can lead to a variety of costs, depending on the strategies selected, or required (such as hazardous materials removal or encapsulation during demolition or renovation, removal or encapsulation of contaminated soils, and/or remediation of contaminated soils using chemical additives).

- Cost impact: While the cost of this credit can be substantial, it is rarely a significant factor in site selection for most projects. A brownfield site may be selected for other reasons, such as property availability, transit connections, etc. Costs to mitigate hazardous materials in an existing building (demolition or renovation) would typically be incurred regardless of sustainable design goals. The cost of basic remediation of a brownfield site can range from $50,000 / acre to as much as $2 million per acre, although the typical range is $300,000 to $500,000 per acre. For development densities of 80,000 SF to 120,000 SF / acre, this amounts to $3.00 to $6.00/SF of building area. There will also be additional soft cost for design, testing and monitoring. These costs would be typically required in a brownfield remediation, regardless of pursuit of the LEED credit.

Potential Technologies, Strategies & Goals

- During the site selection process, give preference to brownfield sites.
- Identify tax incentives and property cost savings.
- Coordinate site development plans with remediation activity, as appropriate.

The selected brownfield site is an abandoned automotive repair/dealership built in 1949. It was historically occupied by various automobile sales and service businesses through the mid-1990s, and has reportedly been vacant since then.

SS 4-1: Alternative Transportation - Public Transportation Access

Points Available 6
DSC Potential Points Achieved 6

Intent

Reduce pollution and land development impacts from automobile use.

Requirement

Locate project within 1/2 mile of a commuter rail, light rail or subway station or 1/4 mile of two or more public or campus bus lines usable by building occupants.

Feasibility

This credit is usually a result, rather than a driver, of site selection, and credit compliance is a consequence of other factors. Because of this, the credit is suitable for this urban project, where the site happens to comply. The project can also provide shuttle buses to transport staff and visitors from the project site to regional bus or train stops to meet the credit requirements. These measures can reduce the amount of parking needed, and therefore reduce project costs.

- Cost impact: In practice, this credit typically has no construction or soft cost implications.

Potential Technologies, Strategies & Goals

- Perform a transportation survey of future building occupants to identify transportation needs.
- The building is located near mass transit.
- Develop a "pedestrian first policy" and safe linkages to existing transportation networks.
- Educate building occupants and community on alternative transportation plans

Both Detroit inbound and out bound bus stops [Rte 21 & 305] are located in front of the DSC on Grand River. The two routes serve many amenities along Grand River into downtown Detroit and out to several communities and neighborhoods. Connector routes to regional bus systems, Amtrak, Detroit Metro Airport and Windsor, Canada are easily accessible.

A policy for *pedestrian first* will be instituted as part of the work culture as well as education to intended audience and participants visiting the DSC.

SS 4-2: Alternative Transportation - Bicycle Storage and Changing

Points Available 1
DSC Potential Points Achieved 1

Intent

Reduce pollution and land development impacts from automobile use.

Requirement

Provide secure bicycle racks and/or storage within 200 yards of a building entrance for 5% or more of all building users (measured at peak periods) and;
Provide shower and changing facilities in the building, or within 200 yards of a building entrance, for 0.5% of full-time equivalent (FTE) occupants.

Feasibility

This is a relatively inexpensive credit with low design impact and simply requires the installation of adequate bicycle racks and shower/ changing facilities. The cost for this credit is likely to show up not as cost per square foot, but rather in the additional square footage to be built or reduced useable square footage within a building from the development of the shower facilities.

- Cost impact: In practice, this credit typically has very small construction or soft cost implications. The number of racks and showers required to meet this credit is usually quite small. Encouragement of the building users to use bicycles and other alternate transportations may alleviate the need for parking spaces and actually save money.

Potential Technologies, Strategies & Goals

- The building is designed with transportation amenities such as bicycle racks and shower/changing facilities.

Secured bicycle racks/storage and shower/changing facilities are provided.

SS 4-3: Alternative Transportation - Low-Emitting and Fuel- Efficient Vehicles

Points Available 3
DSC Potential Points Achieved 3

Intent

Reduce pollution and land development impacts from automobile use.

Requirement

One of the following four options must be met;

- Provide preferred parking for low-emitting and fuel-efficient vehicles. 2 for 5% of the total vehicle parking capacity of the site. Providing a discounted parking rate is an acceptable substitute for preferred parking for low-emitting/fuel-efficient vehicles, or;
- Install alternative-fuel fueling stations for 3% of the total vehicle parking capacity of the site. Liquid or gaseous fueling facilities must be separately ventilated or located outdoors, or;
- Provide low-emitting and fuel-efficient vehicles for 3% of full-time equivalent (FTE) occupants with preferred parking for these vehicles.
- Provide building occupants access to a low-emitting or fuel-efficient vehicle-sharing program.

Feasibility

This credit is typically achieved in the least costly manner – that is, by providing preferred parking for efficient and alternatively fueled vehicles. Refueling stations can be added almost any time during design and construction. This point could also be awarded if the owner provides a fleet of alternatively fueled vehicles, but typically few facilities take this route.

- Cost impact: This credit typically has very minor construction and soft cost implications; electric refueling stations typically cost between $5,000 and $20,000 for a two car station, while costs for signage are negligible.

Potential Technologies, Strategies & Goals

- Provide transportation amenities such as alternative-fuel refueling stations.
- Consider sharing the costs and benefits of refueling stations with neighbors. However, liquid or gaseous fueling facilities are typically deemed impractical due to cost, security, and practicality concerns.

The project will provide three (3) preferred parking spaces for low-emitting and fuel-efficient vehicles. This is an opportunity for the DSC to further demonstrate alternative low-emitting and fuel-efficient vehicles as part of the education program.

SS 4-4: Alternative Transportation - Parking Capacity

Points Available 2
DSC Potential Points Achieved 2

Intent

Reduce pollution and land development impacts from automobile use.

Requirement

One of the following four options must be met;

- Size parking capacity to meet but not exceed minimum local zoning requirements. Provide preferred parking for carpools or vanpools for 5% of the total parking spaces.
- For projects that provide parking for less than 5% of full-time equivalent (FTE) building occupants: Provide preferred parking for carpools or vanpools, marked as such, for 5% of total parking spaces.
- Provide no new parking.
- Provide 25% fewer parking spaces than the applicable standard listed in the 2003 Institute of Transportation Engineers (ITE) "Parking Generation" study

Feasibility

As with SS 4-3, this credit is not difficult to achieve, but compliance may be unacceptable in many facilities due to restrictions on available parking for users. Where sites are highly constrained and parking limited by available space, the credit may be met simply as a result of the program limitations. Also, in many projects parking is constrained to such a degree that it would not be possible to exceed local zoning requirements.

- Cost impact: This credit can actually reduce construction and soft costs by reducing overall parking and vehicular circulation area.

Potential Technologies, Strategies & Goals

- Minimize parking lot size.
- Consider sharing parking facilities with adjacent buildings.
- Consider alternatives that will limit the use of single occupancy vehicles.
- Designate preferred parking for alternative fuel vehicles.
- Establish a car and van-pool program for building occupants and designate preferred parking stalls.

Only preferred parking is provided on site for low-emitting and fuel-efficient vehicles or alternative fuel vehicles. All staff and visitor parking will be shared with a church parking lot adjacent to the site. The site has limited available space dedicated for parking.

SS 5-1: Reduced Site Disturbance - Protect or Restore Habitat

Points Available 1
DSC Potential Points Achieved 1

Intent

Conserve existing natural areas and restore damaged areas to provide habitat and promote biodiversity.

Requirement

- Case 1 - Greenfield Sites - Limit all site disturbance to the following parameters:.
- Case 2 - Previously Developed Areas or Graded Sites
  Restore or protect a minimum of 50% of the site (excluding the building footprint) or 20% of the total site area (including building footprint), whichever is greater, with native or adapted vegetation (Projects earning SS Credit 2: Development Density and Community Connectivity may include vegetated roof surface in this calculation if the plants are native or adapted, provide habitat, and promote biodiversity.)

Feasibility

For greenfield sites, the main strategies relate to managing the construction and ensuring that construction activities are kept within the limitations specified in the requirement. While this is a construction management issue, it is essential that the design team understand the constraints, and that these are detailed within the construction bid documents. Credit requirements can be difficult if not impossible to achieve at greenfield sites where excavation below grade of more than one story is required.

- Cost impact: For previously developed sites, the main strategies relate to designing appropriate site restoration. This credit can be challenging to achieve in urban areas because of limitations in site area which make it difficult to find the required site area for restoration. For urban sites with large impervious areas, such as surface parking lots, strategies can include construction of parking structures to allow for conversion of paved areas into landscaped areas. Green roofs at parking structures and buildings can contribute to this point. Many of the strategies for achieving this credit can be combined with other credits. For example, landscaped areas can be designed to provide natural habitat, to manage and filter stormwater, and to facilitate both heat island credits. In many jurisdictions, strict stormwater mandates can be cost-effectively met using native landscape. Where strategies and credits can be integrated, costs can be greatly minimized. This credit typically does not incur significant construction costs, where sufficient land is available to answer parking needs and leave room for native plantings. Where space is a premium and parking must be put underground or in a structure to provide space for natural habitat, costs can be significant or prohibitive. If measures can be used that allow achievement of several sustainable design goals at once, costs can be controlled. There are usually relatively small soft cost implications.

Potential Technologies, Strategies & Goals

- For this previously developed site, use of a local consultants and educational facilities will be used as a resource for the selection of appropriate native or adapted plants.
- Prohibit plants listed as invasive or noxious weed species will not be used. Once established, native/adapted plants will require minimal or no irrigation; will not require active maintenance such as mowing or chemical inputs such as fertilizers, pesticides or herbicides; and provide habitat value and promote biodiversity through avoidance of monoculture plantings.

SS 5-2: Reduced Site Disturbance - Maximize Open Space

Points Available 1
DSC Potential Points Achieved 1

Intent

Conserve existing natural areas and restore damaged areas to provide habitat and promote biodiversity.

Requirement

- Case 1 - Sites with Local Zoning Open Space Requirements
  Reduce the development footprint and/or provide vegetated open space within the project boundary such that the amount of open space exceeds local zoning requirements by 25%.
- Case 2 - Sites with No Local Zoning Requirements (e.g. some university campuses, military bases) Provide a vegetated open space area adjacent to the building that is equal in area to the building footprint.
- Case 3 - Sites with Zoning Ordinances but No Open Space Requirements Provide vegetated open space equal to 20% of the project site area.
- All Cases - For projects in urban areas that earn SS Credit 2: Development Density and Community Connectivity, vegetated roof areas can contribute to credit compliance. For projects in urban areas that earn SS Credit 2: Development Density and Community Connectivity, pedestrian-oriented hardscape areas can contribute to credit compliance. For such projects, a minimum of 25% of the open space counted must be vegetated. Wetlands or naturally Wetlands or naturally designed ponds may count as open space and the side slope gradients average 1:4 (vertical: horizontal) or less and are vegetated.

Feasibility

The typical strategy for meeting this credit is to limit hardscape and parking areas, to allow sufficient open space. For projects that earn SS 2, this point is achieved by providing a green roof and pedestrian oriented hardscape.

- Cost impact: for this credit are typically zero to minimal for rural, suburban, and campus sites. For dense urban sites, costs can be minimal to significant due to densification of the building and/or addition of a green roof.

Potential Technologies, Strategies & Goals

- Perform a site survey to identify site elements and adopt a master plan for developing the project site
- Regenerate ecosystems to attract local fauna (birds, bees, butterflies etc.)
- Consult with local botanist/biologist to provide expertise on how the DSC can bring back the native ecosystem
- This suitable building location and the design of the building footprint will minimize site disruption. Strategies include;
  - stacking the building program
  - sharing parking facilities with neighbors to maximize the amount of open space on the site.

SS 6-1: Stormwater Management - Quantity Control

Points Available 1
DSC Potential Points Achieved 1

Intent

To limit disruption of natural hydrology by reducing impervious cover, increasing on-site infiltration, reducing or eliminating pollution from stormwater runoff and eliminating contaminants.

Requirement

- Case 1 - Sites with Existing Imperviousness 50% or Less;
  - Option 1 - Implement a stormwater management plan that prevents the post development peak discharge rate and quantity from exceeding the predevelopment peak discharge rate and quantity for the 1- and 2-year 24-hour design storms.
  - Option 2 - Implement a stormwater management plan that protects receiving stream channels from excessive erosion. The stormwater management plan must include stream channel protection and quantity control strategies.
- Case 2 - Sites with Existing Imperviousness Greater Than 50%;
  Implement a stormwater management plan that results in a 25% decrease in the volume of stormwater runoff from the 2-year 24-hour design storm.

Feasibility

100% of the rainwater will be retained on site through an integrated systems approach. Rainwater will dissipate through swales in the streetscape, the greenroof, and infiltration through permeable pavements, stored in cisterns to supply water to the landscape and art sculpture; and gray water supply.

- Cost impact: Site size plays a significant role in whether or not the stormwater related points result in additional cost. Swales tend to have a minimal cost impact; retention or detention ponds are more expensive; and installation of stormwater collection tanks can be very costly. Projects on large sites tend to install swales or ponds, while buildings on limited sites (usually urban) use collection tanks and filters to meet the requirements. Increasingly, stormwater management is required by local jurisdictions; in such cases the cost is included in the base design, not added. In some cases, the project may be required to foot the bill to increase capacity of the local infrastructure; in such cases onsite measures may be more cost-effective. Local weather patterns will impact cost; frequency and amount of rainfall will determine the scale of both landscape and tank interventions. Soil conditions also can affect cost; sites with clay soils, high water tables or bedrock will not be able to use the swale and surface infiltration approaches. Diversion of rainwater for use in irrigation or sewage conveyance will satisfy point requirements, and is becoming a more accepted and used approach to compliance. The provision of tanks and additional piping can represent a significant cost. In practice, many projects may not have sufficient site area to develop the less costly solutions to this credit. If this is the case, the point can be challenging to achieve.

Potential Technologies, Strategies & Goals

- Design the project site to maintain natural stormwater flows by promoting infiltration
- Specify vegetated roofs, pervious paving and other measures to minimize impervious surfaces
- Reuse stormwater for non-potable uses such as landscape irrigation, toilet and urinal flushing, and custodial uses.

SS 6-2: Stormwater Management - Quality Control

Points Available 1
DSC Potential Points Achieved 1

Intent

To limit disruption and pollution of natural water flows by managing stormwater runoff.

Requirements

Implement a stormwater management plan that reduces impervious cover, promotes infiltration and captures and treats the stormwater runoff from 90% of the average annual rainfall8 using acceptable best management practices (BMPs).

Feasibility

The strategies for meeting this point typically depend on the extent of site area available for stormwater management. This site with small landscaped areas, it is possible to provide treatment through the use of landscape elements such as vegetated swales with bio-engineered soils to infiltrate water. Rainwater seeped into the ground will treat a high portion of pollutants associated with the rainwater runoff. Site conditions do allow use of filtration tanks and/or oil separators at inlets. It may be possible to capture rainwater in cisterns and reuse it for irrigation and/or non-potable water use. An additional element is the development of a landscape management plan, aimed at reducing the total phosphorus load entering the stormwater system.

- Cost impact: In practice, some projects may not have sufficient site area to develop the less costly solutions to this credit, and as a result, the credit can be very challenging or expensive to achieve. However, many jurisdictions require the filtration of stormwater before it enters the municipal system; in such cases the cost is included in the base design, not added. An integrated design that uses landscape and other design elements to help meet credit requirements will reduce construction and operations costs. Diversion of rainwater for use in irrigation or sewage conveyance can satisfy, or assist in satisfying, point requirements, and is becoming a more accepted and used approach to compliance. The provision of tanks and additional piping can represent a significant cost.

Potential Technologies, Strategies & Goals

- Use alternative surfaces (e.g., vegetated roofs, pervious pavement, grid pavers) and nonstructural techniques (e.g., rain gardens, vegetated swales, disconnection of imperviousness, rainwater recycling) to reduce imperviousness and promote infiltration and thereby reduce pollutant loadings.
- Use sustainable design strategies (e.g., low-impact development, environmentally sensitive design) to create integrated natural and mechanical treatment systems such as constructed wetlands, vegetated filters and open channels to treat stormwater runoff.
- Another approach to achieving the credit is the use of subsurface water quality inlets with sand filters (biofiltration). Depending on the filter design and the contaminant concentrations of the influent, sand filters can reduce both TSS and TP at rates at or above those defined in the credit criteria.
- The U.S. Green Building Council has also determined that the phosphorous reduction requirement of this credit can be achieved through a “source reduction” approach that involves minimized fertilization of landscape plantings, low or no-phosphate cleaning agents, and similar strategies. These measures need to be specified in a building/landscape maintenance plan. If this approach is used, it may be feasible to meet the TSS criteria through other types of water quality inlets (besides sand filters).

SS 7-1: Heat Island Effect - Non-Roof

Points Available 1
DSC Potential Points Achieved 1

Intent

To reduce heat islands to minimize impacts on microclimates and human and wildlife habitats.

Requirement

- Option 1 - Use any combination of the following strategies for 50% of the site hardscape (including roads, sidewalks, courtyards and parking lots):
    - Provide shade from the existing tree canopy or within 5 years of landscape installation. Landscaping (trees) must be in place at the time of occupancy.
    - Provide shade from structures covered by solar panels that produce energy used to offset some nonrenewable resource use.
    - Use hardscape materials with an SRI of at least 29.
    - Use an open-grid pavement system (at least 50% pervious).

- Option 2 - Place a minimum of 50% of parking spaces under cover. Any roof used to shade or cover parking must have an SRI of at least 29, be a vegetated green roof or be covered by solar panels that produce energy used to offset some nonrenewable resource use.

Feasibility

This credit is most often achieved by changing the color of concrete paving and adding shade elements at relatively low cost. Where surface parking/service yard is provided, this credit can be achieved at minimal or no added cost by providing open grid paving, porous pavers or gravel in portions of the service yard.

- Cost impact: In practice, this credit typically has very minor construction and soft cost implications, since the most economical way in which to achieve this credit is to provide shade trees in parking areas. We have not seen projects chose to provide structured parking simply to achieve this point.

Potential Technologies, Strategies & Goals

- Employ strategies, materials and landscaping techniques that reduce the heat absorption of exterior materials.
- Use shade (calculated on June 21, noon solar time) from native or adapted trees and large shrubs, vegetated trellises or other exterior structures supporting vegetation.
- Consider using new coatings and integral colorants for surface materials to achieve light-colored surfaces.
- Position photovoltaic cells to shade impervious surfaces.
- Consider replacing constructed surfaces (e.g., roof, roads, sidewalks, etc.) with vegetated surfaces such as vegetated roofs and open grid paving or specify high-albedo materials, such as concrete and pavers, to reduce heat absorption.

SS 7-2: Heat Island Effect – Roof

Points Available 1
DSC Potential Points Achieved 1

Intent

To reduce heat islands to minimize impacts on microclimates and human and wildlife habitats.

Requirement

Use ENERGY STAR compliant (high reflective) AND low emissivity roofing for a minimum of 75% of the roof surface;
OR
Install a "green" (vegetated) roof for at least 50% of the roof area. Combinations of the high albedo and vegetated roof can be used providing they collectively cover 75% of the roof area.

Feasibility

The typical approach to this credit is to use a high emissivity roof. While costs for these are usually slightly ($1 - $2/SF) more than conventional black roofs.

- Cost impact: The overall impact on the cost of the project is usually relatively low, since roofs make up a very small part of the total project cost. Increasingly, projects use a green roof to achieve this credit. The added cost is significant, adding typically between $10 and $30/sf, but green roofs can facilitate achievement of LEED credits for stormwater management and filtration, open space, and natural habitat, as well as contributing to energy efficiency. The use of green roofs is increasing as designers and owners become more familiar with them and as the value of green roofs for stormwater management are more widely accepted.

Potential Technologies, Strategies & Goals

- The most direct strategy for meeting this credit is to install a white or light-colored roof membrane system. Typical systems include the following:
  - White TPO
  - White PVC
  - White EPDM
- A vegetated roofing system is considered for this project as part of the stormwater management, or in this case a portion of the green roof provides an additional building function for exterior programmed space.

SS 8: Light Pollution Reduction

Points Available 1
DSC Potential Points Achieved 1

Intent

Eliminate light trespass from the building site, improve night sky access, and reduce development impact on nocturnal environments.

Requirement

Interior Lighting

- Option 1 - Reduce the input power (by automatic device) of all non-emergency interior luminaries with a direct line of sight to any openings in the envelope (translucent or transparent) by at least 50% between 11 p.m. and 5 a.m. After-hours override may be provided by a manual or occupant-sensing device provided the override lasts no more than 30 minutes.
- Option 2 - All openings in the envelope (translucent or transparent) with a direct line of sight to any non-emergency luminaries must have shielding (controlled/closed by automatic device for a resultant transmittance of less than 10% between 11 p.m. and 5 a.m.).

Exterior Lighting

Light areas only as required for safety and comfort. Exterior lighting power densities shall not exceed those specified in ANSI/ASHRAE/IESNA Standard 90.1-2007 with Addenda 1 for the documented lighting zone. Justification shall be provided for the selected lighting zone. Lighting controls for all exterior lighting shall comply with section 9.4.1.3 of ANSI/ASHRAE/IESNA Standard 90.1- 2007, without amendments.

Feasibility

The primary strategy for this credit involves careful site lighting design and fixture selection. Many projects attempt this credit, but not all achieve it. Clients and code officials often perceive this point to be at odds with security requirements, although this situation is increasingly rare. In order to be successful with this credit, therefore, it is important to include site lighting in the earliest stages of site planning, and to include security and site safety in the considerations of the design.

- Cost impact: Where the credit is attempted, the credit typically has very low cost impact, both for construction and soft costs.

Potential Technologies, Strategies & Goals

- Adopt site lighting criteria to maintain safe light levels while avoiding off-site lighting and night sky pollution.
- Minimize site lighting where possible, and use computer software to model the site lighting.
- Technologies to reduce light pollution include full cutoff luminaries, low-reflectance surfaces and low-angle spotlights.
- Carefully selecting site lighting fixtures for use at property boundaries
- Checking interior lighting layouts at spaces along the building perimeter to ensure that luminaries are not directing most of their light out the windows.

LEED® 2009 for New Construction & Major Renovations
Water Efficiency

Points Available 10
DSC Potential Points Achieved 10

Of the credits in Water Efficiency, most projects try for WE 1.1 and 3.1; few attempt the other credits, which can be quite challenging, unless they are seeking the higher levels of LEED certification.

			Water Efficiency	**Possible Points: 10**
Y		Prereq 1	Water Use Reduction—20% Reduction	
		Credit 1	Water Efficient Landscaping	2 to 4
		Credit 2	Innovative Wastewater Technologies	2
		Credit 3	Water Use Reduction	2 to 4

WE Prerequisite 1: Water Use Reduction
Required

Intent
To increase water efficiency within buildings to reduce the burden on municipal water supply and wastewater systems.

Requirements
Employ strategies that in aggregate use 20% less water than the water use baseline calculated for the building (not including irrigation).

Potential Technologies, Strategies & Goals
- WaterSense-certified fixtures and fixture fittings should be used where available.
- Use high-efficiency fixtures (e.g., water closets and urinals) and dry fixtures, such as toilets attached to composting systems, to reduce potable water demand.
- On-site sources of water are considered as an alternative (e.g., rainwater, stormwater, and air conditioner condensate) and graywater for nonpotable applications such as custodial uses and toilet and urinal flushing. The quality of any alternative source of water used must be taken into consideration based on its application or use.
- Establish partnerships with Michigan Department of Environmental Quality (MDEQ) to test quality of on-site collected potable water and effectiveness of technologies being implemented at the DSC.

WE 1: Water Efficient Landscaping

Points Available 2 to 4
DSC Potential Points Achieved 4

Intent

To limit or eliminate the use of potable water or other natural surface or subsurface water resources available on or near the project site for landscape irrigation.

Requirement

Option 1 (2 points)
Reduce potable water consumption for irrigation by 50% from a calculated midsummer baseline case. Reductions must be attributed to any combination of the following items:

- Plant species, density and microclimate factor
- Irrigation efficiency
- Use of captured rainwater
- Use of recycled wastewater
- Use of water treated and conveyed by a public agency specifically for non-potable uses

Option 2 (4 points)
No Potable Water Use or Irrigation. Meet the requirements for Option 1. and;

- Path 1 Use only captured rainwater, recycled wastewater, recycled graywater or water treated and conveyed by a public agency specifically for nonpotable uses for irrigation. Or;
- Path 2 Install landscaping that does not require permanent irrigation systems.

Feasibility

There are two main strategies for meeting these credits. The first is to use landscaping that requires less irrigation primarily by reducing the extent of grass and by increasing the use of native, drought tolerant and adaptive plants. The second is to use more efficient irrigation methods or reclaimed water for irrigation. LEED requires both strategies to achieve this credit. There can be a perceived sanitation issue with using reclaimed, grey, or rainwater for irrigation. Some projects address such concerns by ensuring that the irrigation water is never touchable by humans; this is done by using below-ground irrigation. Specific actions include:

- Providing native, drought tolerant plants
- Avoiding the use of turf grass
- Using high efficiency irrigation methods such as drip irrigation or automated controls with moisture sensors
- Using municipally provided reclaimed water for irrigation
- Capturing site rainwater to reuse for irrigation
- Using HVAC condensate or cooling tower waste water for irrigation (only possible with non-chemical cooling tower treatments systems)
- Installing temporary irrigation for establishment of plants only (hose bibs)

- Cost impact: In practice, these credits typically have very small construction and soft cost implications, and the election to pursue these credits is driven more by preference for appearance than by cost. If no permanent irrigation system is installed, costs can actually be reduced. WE 1-1 is usually accomplished by the use of drought tolerant planting and efficient irrigation. Where municipally provided reclaimed water is used, the cost is limited to the cost of connecting to the reclaimed water system, and of providing filtration if needed. In many areas where reclaimed water is municipally provided, it is mandatory to use it for irrigation; in such cases there is no added cost. The most expensive strategies involve rainwater storage. The costs for water storage can be significant, if large volumes are required for irrigation. This strategy is typically not attempted in areas with very short rainy seasons. If cooling tower waste water is to be used for irrigation, storage tanks can be

minimal in size, since cooling towers are likely to be running year round and will provide a consistent supply of water. Costs associated will be for collection, storage, and minimal filtration. While potable water costs are currently quite low, it is extremely likely that costs will rise dramatically in the near future. Minor design changes now could save major costs later.

Potential Technologies, Strategies & Goals

- Perform a soil/climate analysis to determine appropriate plant material and design the landscape with native or adapted plants to reduce or eliminate irrigation requirements.
- Where irrigation is required, use high-efficiency equipment and/or climate-based controllers.
    - Employ automatic irrigation system controls, particularly for sprinkler systems. Controls include timers, rain sensors, and soil moisture sensors.
    - Employ drip irrigation systems in lieu of sprinkler systems for non-turf planting areas.

WE 2: Innovative Wastewater Technologies

Points Available 2
DSC Potential Points Achieved 2

Intent

Reduce the generation of wastewater and potable water demand, while increasing the local aquifer recharge.

Requirement

Reduce the use of municipally provided potable water for building sewage conveyance by a minimum of 50%;
Or;
Treat 100% of wastewater on site to tertiary standards.

Feasibility

Low-flow and waterless flush fixtures are typically available at no added cost. Reclaimed water, gray water, and rainwater systems (which would typically include cisterns and filtration systems) all require the provision of additional supply. Typically this could be expected to add $4 - $8/SF over the cost of the entire building. There would be minor increases in design and inspection costs, and moderate documentation costs associated with the necessary calculations and demonstration of compliance. On-site wastewater treatment adds significantly to the cost of a facility.

Potential Technologies, Strategies & Goals

- Specify high-efficiency fixtures and dry fixtures (e.g., composting toilet systems, nonwater-using urinals) to reduce wastewater volumes. Fixture types that could contribute toward this credit include:
    - Waterless urinals
    - Dual flush toilets (1.6/0.8 gallons per flush[gpf])
    - Ultra low flush toilets (1.1 to 1.4 gpf).

  LEED calculations typically indicate that these fixture types alone could not achieve 50 percent water use reduction for sewage conveyance. In addition, the dual flush and ultra low flush toilets are currently available only as tank type fixtures, as opposed to flush valve fixtures that would typically
  be specified for large commercial or institutional buildings. Achieving the credit would therefore require one of the following options:
    - Stormwater collection (from the roof or site) and treatment systems
    - Greywater collection and treatment systems
    - Blackwater collection and treatment systems
    - Composting toilets.
- Installation of on-site Biofilteration for processing waste water, capturing harmful chemicals or silt from surface runoff, and microbiotic oxidation of contaminants in air.
- Consider on-site waste water treatment systems such as Living Machine or Solar Aquatic Technologies to treat liquid waste on site. http://www.livingmachines.com
- Establish a partnership with Michigan Department of Environmental Quality (MDEQ) to test quality of on-site collected potable water and effectiveness of technologies implemented at the DSC.

WE 3: Water Use Reduction

Points Available 2 to 4
DSC Potential Points Achieved 4

Intent

To further increase water efficiency within buildings to reduce the burden on municipal water supply and wastewater systems.

Requirement

Employ strategies that in aggregate use less water than the water use baseline calculated for the building (not including irrigation). The minimum water savings percentage for each point threshold is as follows:.

- 30% 2 points
- 35% 3 points
- 40% 4 points

Feasibility

The typical approach is to use low flow fixtures for lavatories and showers, motion sensor operated devices, reduced flush or dual flush toilets, and waterless or reduced flush urinals.

- Cost Impact: These strategies have little premium costs, and in most cases will be sufficient to ensure achievement of the first point associated with this credit and often the second. For healthcare and other facilities with different potable water demands, or where potable water flow is required for hygiene or infection control reasons, this credit can be challenging.

Potential Technologies, Strategies & Goals

- Use WaterSense-certified fixtures and fixture fittings where available.
- Use high-efficiency fixtures (e.g., water closets and urinals) and dry fixtures, such as toilets attached to composting systems, to reduce the potable water demand.
- Consider using alternative on-site sources of water (e.g., rainwater, stormwater, and air conditioner condensate, graywater) for nonpotable applications (e.g., toilet and urinal flushing, custodial uses). The quality of any alternative source of water being used must be taken into consideration based on its application or use.

LEED® 2009 for New Construction & Major Renovations
Energy and Atmosphere

Points Available 35
DSC Potential Points Achieved 20

Energy and Atmosphere credits are not strongly pursued in many cases, other than the initial two to four points for energy cost reduction. Energy credits do require a high degree of focus, and can be challenging for many projects. They contain some of the most readily available Life Cycle cost benefits.

			Energy and Atmosphere	Possible Points: 35
Y		Prereq 1	Fundamental Commissioning of Building Energy Systems	
Y		Prereq 2	Minimum Energy Performance	
Y		Prereq 3	Fundamental Refrigerant Management	
		Credit 1	Optimize Energy Performance	1 to 19
		Credit 2	On-Site Renewable Energy	1 to 7
		Credit 3	Enhanced Commissioning	2
		Credit 4	Enhanced Refrigerant Management	2
		Credit 5	Measurement and Verification	3
		Credit 6	Green Power	2

EA Prerequisite 1: Fundamental Commissioning of the Building Energy Systems
Required

Intent
To verify that the project's energy-related systems are installed, and calibrated to perform according to the owner's project requirements, basis of design and construction documents.

Requirement
Implement all of the following fundamental best practice commissioning procedures:

- Engage a commissioning team that does not include individuals directly responsible for the project design or construction management.
- Review design intent and basis of design documentation.
- Incorporate commissioning requirements in the construction documents.
- Develop and utilize a commissioning plan.
- Verify installation, functional performance, training and operation and maintenance documentation.
- Complete a commissioning report.

Feasibility
This credit has construction and soft cost implications, although increasingly facilities undertake basic commissioning regardless of this credit. Usually commissioning is viewed as a soft cost, and so the primary cost impact shows up in that category. There are, however, some additional construction costs related to commissioning arising from the additional work required of the contractor to support the commissioning process, and the corrective work required as a result of the commissioning.

- Cost impact: Basic commissioning typically costs in the range of $1.50 - $3.00/SF. This credit can provide significant benefits, both in the short and long term. The greatest benefits are achieved with the use of Additional Commissioning (EA 3), but the basic conditioning under this prerequisite can provide significant benefits. In the short term, commissioning can help the project team develop an efficient design, and in conjunction with design modeling, serve to reduce overall design and construction time. In the long term, the commissioning has been shown to have very strong improvements in system performance and reduced operating cost.

Potential Technologies, Strategies & Goals
- Engage a Commissioning Agent as early as possible in the design process.
    - Determine the owner's project requirements
    - Develop and maintain a commissioning plan for use during design and construction
    - Incorporate commissioning requirements in bid documents.
    - Assemble the commissioning team, and prior to occupancy verify the performance of energy consuming systems
    - Complete the commissioning reports with recommendations prior to accepting the commissioned systems.

Owners are encouraged to seek out qualified individuals to lead the commissioning process. Qualified individuals are identified as those who possess a high level of experience in the following areas:

- Energy systems design, installation and operation
- Commissioning planning and process management
- Hands-on field experience with energy systems performance, interaction, start-up, balancing, testing, troubleshooting, operation and maintenance procedures

- Energy systems automation control knowledge

Owners are encouraged to consider including water-using systems, building envelope systems, and other systems in the scope of the commissioning plan as appropriate. The building envelope is an important component of a facility that impacts energy consumption, occupant comfort and indoor air quality. While this prerequisite does not require building envelope commissioning, an owner can achieve significant financial savings and reduce risk of poor indoor air quality by including it in the commissioning process.

EA Prerequisite 2: Minimum Energy Performance

Required

Intent

To establish the minimum level of energy efficiency for the proposed building and systems to reduce environmental and economic impacts associated with excessive energy use.

Requirement

- Option 1 - Whole Building Energy Simulation
  Demonstrate a 10% improvement in the proposed building performance rating for new buildings, or a 5% improvement in the proposed building performance rating for major renovations to existing buildings, compared with the baseline building performance rating.
- Option 2 - Prescriptive Compliance Path
  Comply with the prescriptive measures of the ASHRAE Advanced Energy Design Guide appropriate to the project scope, outlined below. Project teams must comply with all applicable criteria as established in the Advanced Energy Design Guide for the climate zone in which the building is located.

Feasibility

The energy performance standards set by the prerequisite are not particularly difficult to meet, and should not typically lead to significant increases in first cost. If the decision to pursue energy efficiency is made early in design, it should be possible to meet minimum requirements without adding cost. With an integrated design approach, savings may even be realized. If energy efficiency is not addressed early the costs can become significant.

Potential Technologies, Strategies & Goals

- Design the building envelope and systems to optimize energy efficiency.
- Use a computer simulation model to conduct a whole building energy analysis and identify the most cost-effective energy efficiency measures.
- Quantify energy performance compared with a baseline building.

EA Prerequisite 3: Fundamental Refrigerant Management
Required

Intent
To reduce stratospheric ozone depletion.

Requirement
Zero use of chlorofluorocarbon (CFC)-based refrigerants in new base building heating, ventilating, air conditioning and refrigeration (HVAC&R) systems. When reusing existing base building HVAC equipment, complete a comprehensive CFC phase-out conversion prior to project completion. Phase-out plans extending beyond the project completion date will be considered on their merits.

Feasibility
Most new facilities will automatically meet this prerequisite, unless an existing central plant uses CFC refrigerants. Equipment replacement can be costly and is typically undertaken only when that equipment has reached the end of its useful life. Since the prerequisite only requires the commitment to future replacement, there are no construction cost implications.

Potential Technologies, Strategies & Goals
When reusing existing HVAC systems, conduct an inventory to identify equipment that uses CFC-based refrigerants and provide a replacement schedule for these refrigerants. For new buildings, specify new HVAC equipment in the base building that uses no CFC-based refrigerants.

EA 1: Optimize Energy Performance

Points Available 1 to 19
DSC Potential Points Achieved 10

Intent

To achieve increasing levels of energy performance beyond the prerequisite standard to reduce environmental and economic impacts associated with excessive energy use.

Requirement

Select 1 of the 3 compliance path options described below. Project teams documenting achievement using any of the 3 options are assumed to be in compliance with EA Prerequisite 2: Minimum Energy Performance.

- Option 1 - Whole Building Energy Simulation (1–19 points)
  Demonstrate a percentage improvement in the proposed building performance rating compared with the baseline building performance rating. The minimum energy cost savings percentage for each point threshold is as follows: (For Existing Buildings)
  - 8% 1 point
  - 10% 2 points
  - 12% 3 points
  - 14% 4 points
  - 16% 5 points
  - 18% 6 points
  - 20% 7 points
  - 22% 8 points
  - 24% 9 points
  - 26% 10 points
  - 28% 11 points
  - 30% 12 points
  - 32% 13 points
  - 34% 14 points
  - 36% 15 points
  - 38% 16 points
  - 40% 17 points
  - 42% 18 points
  - 44% 19 points
- Option 2 - Prescriptive Compliance Path (1 point)
  Comply with the prescriptive measures of the ASHRAE Advanced Energy Design Guide appropriate to the project scope, outlined below. Project teams must comply with all applicable criteria as established in the Advanced Energy Design Guide for the climate zone in which the building is located.
- Option 3 - Prescriptive Compliance Path: Advanced Buildings Core Performance Guide (1–3 points)
  Comply with the prescriptive measures identified in the Advanced Buildings Core Performance Guide developed by the New Buildings Institute. The building must meet the following requirements:
  - Less than 100,000 square feet.
  - Comply with Section 1: Design Process Strategies, and Section 2: Core Performance Requirements.
  - Health care, warehouse or laboratory projects are ineligible for this path.

Feasibility

Most projects in our sample that are pursuing LEED certification seek at least two of the energy optimization credits, and many aim for more. With the adoption of the requirement that all projects

must achieve a minimum of two energy points, all LEED seeking projects will need to address energy performance issues in the future. The standards under LEED 2009 are generally more challenging than those under LEED 2.2, but the 10% energy cost reduction required for the first two points should be achievable for most projects, with careful attention to energy performance and energy efficiency measures. Many energy efficiency measures involve little or no additional cost, but rather focus on efficient design, right-sizing of equipment, and improvements in basic building systems. For many building types, these measures can be sufficient for meeting the two point prerequisite and beyond. Going beyond the first two to four points requires much more attention to integrated design and energy efficiency.

- Cost impact: For some building types, improvements in energy efficiency can actually lead to reduced construction cost, since the improvements come from reducing dependence on mechanical systems and improving the passive design of the building. Examples where this can occur include libraries, community centers, schools, and such like, particularly where the climate is relatively benign. For other building types, such as hospitals and laboratories, higher levels of energy efficiency can involve significant increases in first cost. Strategies considered include total heat recovery, careful zoning design with supply air temperature reset, control over air change rate in unoccupied areas, and decoupling of ventilation and thermal loads through such strategies as radiant heating and cooling. Taken together, these strategies can be very effective in delivering significant energy cost reductions even in very demanding buildings, but the cost premium can be quite high. Common strategies for achieving the first two credits include:
    - Energy Load Reduction
    - Occupancy and time of use analysis, leading to rightsizing of systems and careful zoning design
    - Analysis of actual loads in similar existing buildings
    - Envelope improvements, including improved insulation and glazing performance, reduced air infiltration
    - Sunshading and daylighting harvesting, reduced lighting power density
    - Decoupling of thermal and ventilation demands, including radiant heating and cooling
    - Heat recovery from air and water systems
    - Improved Equipment Efficiency
    - Increased duct size leading to reduced fan power requirements
    - Variable frequency drives for motors
    - Condensing stack boilers
    - Sophisticated controls.

Potential Technologies, Strategies & Goals

- Design the building envelope and systems to maximize energy performance.
    - Minimize energy needs for building operation.
    - The DSC will utilize ground source heat pumps.
    - Maximize passive solar strategies.
    - Use exterior and interior solar control strategies specific to each façade in order to minimize solar heat gain in interior spaces and to offset cooling loads. For south facing facades use exterior louvered sunshades.
    - Optimize façade for overall energy efficiency year round.
    - Select high performance glazing systems specific for each façade.
    - Use natural ventilation strategies for cooling indoor environments through the use of operable windows
    - Install green roofing system to reduce mechanical cooling loads and minimize the urban heat island effect

  - Utilize thermal mass to aid in the moderation of indoor temperature.
- Use a computer simulation model to assess the energy performance and identify the most cost-effective energy efficiency measures.
- Install controls and monitoring systems to minimize total building energy consumption. Gather data from annual systems reports and use feedback to improve overall building performance
- Quantify energy performance compared with a baseline building.

Specific building, mechanical, electrical, and plumbing system features to meet the target include:

- High-Performance Glazing
- Roof and Walls with R values established to exceed standard criteria
- Reduction in lighting power densities
- Geothermal heating and cooling plants.
- Variable refrigerant flow system connected to geothermal heating and cooling plants.
- Variable speed drive fans at air handlers
- Dedicate outdoor air system
- Variable speed drive pumps (30 percent minimum part load ratio)
- Solar domestic water heater
- Hybrid heatpump and electric water heater

.

EA 2: Onsite Renewable Energy

Points Available 1 to 3
DSC Potential Points Achieved 3

Intent

Encourage and recognize increasing levels of onsite renewable energy self supply in order to reduce environmental impacts associated with fossil fuel energy use.

Requirement

- Supply at least 5% of the building's total energy use (as expressed as a fraction of annual energy cost) through the use of on-site renewable energy systems. (1 point)
- Supply at least 10% of the building's total energy use (as expressed as a fraction of annual energy cost) through the use of on-site renewable energy systems. (1 additional point)
- Supply at least 20% of the building's total energy use (as expressed as a fraction of annual energy cost) through the use of on-site renewable energy systems. (1 additional point)

Feasibility

On-site generation of renewable energy has a substantial construction cost impact. Installation of these systems usually provides a long term cost savings, although the life cycle cost payback is usually very long even with available credits and incentives. Incorporating renewable energy into design will earn the project at least one additional energy use reduction point. This credit can be cost effective for projects where power needs are fairly low, and the cost of providing grid-based power to remote buildings are substantial.

Potential Technologies, Strategies & Goals

This credit is targeted to on-site renewable energy systems that convert energy from sun, wind, or biomass into usable energy. System examples include:

- Photovoltaic (building-integrated, roof mounted, or site mounted)
- Wind turbines.
- Geothermal energy

When applying these strategies, take advantage of net metering with the local utility.

Passive solar design, solar hot water heating, ground source heat pumps, and daylighting do *not* qualify for points under this credit, because they do not generate power. These strategies are accounted for in Credit EA-1.

EA 3: Enhanced Commissioning

Points Available 2
DSC Potential Points Achieved 2

Intent

Verify and ensure that the entire building is designed, constructed, and calibrated to operate as intended.

Requirement

Commissioning prerequisite, implement or have a contract in place to implement the following additional commissioning tasks:

- A commissioning authority independent of the design team shall conduct a review of the design prior to the construction documents phase.
- An independent commissioning authority shall conduct a review of the construction documents near completion of the construction documents development and prior to issuing the contract documents for construction.
- An independent commissioning authority shall review the contractor submittals relative to systems being commissioned.
- Provide the owner with a single manual that contains the information required for re-commissioning building systems
- Have a contract in place to review building operation with O&M staff, including a plan for resolution of outstanding commissioning related issues within one year after construction completion date

Feasibility

This credit has construction and soft cost implications. Usually commissioning is viewed as a soft cost, and so the primary cost impact shows up in that category. There are, however, additional construction costs related to commissioning arising from the additional work required of the contractor to support the commissioning process and the corrective work required as a result of the commissioning.

- Cost impact: Additional commissioning typically costs in the range of $1.00 - $2.00/SF. This credit can provide significant benefits, both in the short and long term. In the short term, it can help the project team develop an efficient design, and in conjunction with design modeling, serve to reduce overall design and construction time. The short term benefit can be found to some degree with Basic Commissioning (EA Prerequisite 1), but it is most achievable with the additional commissioning.

Potential Technologies, Strategies & Goals

Although it is preferable that the Commissioning Agent be contracted by the owner, for the enhanced commissioning credit the Commissioning Agent may also be contracted through the design firms or construction management firms not holding construction contracts.

The LEED Reference Guide provides detailed guidance on the rigor expected for the following process activities:

- Commissioning design review
- Commissioning submittal review
- Systems manual.

EA 4: Ozone Depletion

Points Available 2
DSC Potential Points Achieved 2

Intent

To reduce ozone depletion and support early compliance with the Montreal Protocol while minimizing direct contributions to climate change.

Requirement

- Option 1 - Do not use refrigerants.
- Option 2 - Select refrigerants and heating, ventilation, air conditioning and refrigeration (HVAC&R) equipment that minimize or eliminate the emission of compounds that contribute to ozone depletion and climate change.:

Feasibility

This credit is becoming quite easy to achieve, as more and more manufacturers provide compliant equipment. Typically, this credit has minor construction cost implications if any, and minimal soft cost and documentation requirements.

Potential Technologies, Strategies & Goals

- Design and operate the facility without mechanical cooling and refrigeration equipment.
- Where mechanical cooling is used, utilize base building HVAC&R systems for the refrigeration cycle that minimizes direct impact on ozone depletion and global climate change.
- Select HVAC&R equipment with reduced refrigerant charge and increased equipment life.
- Maintain equipment to prevent leakage of refrigerant to the atmosphere.
- Use fire suppression systems that do not contain HCFCs or halons.

EA 5: Measurement and Verification

Points Available 3
DSC Potential Points Achieved 3

Intent

To provide for the ongoing accountability of building energy consumption over time.

Requirement

- Option 1 - Develop and implement a measurement and verification (M&V) plan consistent with *Option D: Calibrated Simulation* as specified in the International Performance Measurement & Verification Protocol. The M&V period must cover at least 1 year of post-construction occupancy. Provide a process for corrective action if the results of the M&V plan indicate that energy savings are not being achieved.
- Option 2 - Develop and implement a measurement and verification (M&V) plan consistent with *Option B: Energy Conservation Measure Isolation*, as specified in the International Performance Measurement & Verification Protocol. The M&V period must cover at least 1 year of post-construction occupancy. Provide a process for corrective action if the results of the M&V plan indicate that energy savings are not being achieved.

Feasibility

The cost of metering to the level required by this credit can be significant, and the cost for writing and implementing the measurement and verification program can be substantial. Individual meters are relatively inexpensive, but to provide the quantity required and to provide a good quality reporting system can add $2.00 to $4.00/SF to the overall cost of the project. The cost to write and implement the measurement and verification program can range from $50,000 to $200,000. For some projects, the initial cost is sufficiently high that adoption of this credit is not considered. The cost of monitoring is usually independent of whether the building has a Building Management System (BMS), since BMS systems do not normally provide the level of monitoring required by this credit.

Potential Technologies, Strategies & Goals

- Develop an M&V plan to evaluate building and/or energy system performance.
- Characterize the building and/or energy systems through energy simulation or engineering analysis.
- Install the necessary metering equipment to measure energy use.
- Track performance by comparing predicted performance to actual performance, broken down by component or system as appropriate.
- Evaluate energy efficiency by comparing actual performance to baseline performance.

EA 6: Green Power Strategies

Points Available 2
DSC Potential Points Achieved 0

Intent

Encourage the development and use of grid source, renewable energy technologies on a net zero pollution basis.

Requirement

Engage in at least a 2-year renewable energy contract to provide at least 35% of the building's electricity from renewable sources, as defined by the Center for Resource Solutions' Green-e Energy product certification requirements. All purchases of green power shall be based on the quantity of energy consumed, not the cost.

- Option 1 - Determine Baseline Electricity Use
  Use the annual electricity consumption from the results of EA Credit 1: Optimize Energy Performance.
- Option 2 - Estimate Baseline Electricity Use
  Use the U.S. Department of Energy's Commercial Buildings Energy Consumption Survey database to determine the estimated electricity use.

Feasibility

The first cost of green power contracts is relatively low, but operationally it can add to overall long term costs. The cost for green power or renewable energy credits varies widely, with green power contracts running from below $.01 per kWh in some areas, to over $.15 per kWh in others. Credits usually are in the range of $.02 per kWh. At this rate, it would represent a 15% to 20% increase in electricity cost for a typical user.

Potential Technologies, Strategies & Goals

Green power, as defined by the referenced Green-e program, is electricity that meets the following standards:

- One or more of the following renewable resources generates at least 50 percent of the electricity: solar electric, wind, geothermal, biomass, small hydro facilities, or certified low-impact hydro facilities.
- If a portion of the electricity is nonrenewable, the air emissions to produce the power are equal to or lower than those produced by conventional electricity generation.
- There are no specific purchases of nuclear power.
- The product meets the Green-e new renewable requirement (i.e., the renewable generation facility must have come on-line after 1997 or 1998, depending on the location).

Green-e certified power is available in some parts of the United States through local utility companies or competitive electricity service providers. In these areas, green power is purchased through a contract between the building owner or manager and the green power supplier.

In areas where green power is not available through these means, users can purchase Tradable Renewable Certificates (TRCs), also referred to as "green tags" or "renewable energy certificates." TRCs can be structured as a "lump sum" one-time purchase, based on the projected energy use of a facility. The purchase of a TRC by an electricity user covers the additional costs to displace fossil fuel energy with renewable energy. TRCs do not involve changes with the local utility company or electricity service provider.

While the costs for green power vary based on the supplier, location, and quantity purchased, the premiums generally range from 1.25–2.5 cents/kWh. For multiyear contracts or very large purchases (e.g., greater than 8,000 MWh/year), the cost premium per kWh may be as low as 1 cent.

LEED® 2009 for New Construction & Major Renovations
Materials and Resources

Points Available 14
DSC Potential Points Achieved 8

Materials and Resources credits fall into two sharply distinct categories, with most projects pursuing the credits related to construction waste management, and the first credits for recycled content and local content, and very few pursuing the others. This represents a slight change from our earlier analysis. More projects are pursuing the second construction waste recycling credit, reflecting an increased acceptance of this requirement by the construction community, and fewer projects are pursuing the second recycled content and local content credits, due to the raising of compliance thresholds in these points.

			Materials and Resources	**Possible Points:**	**14**
Y			Prereq 1	Storage and Collection of Recyclables	
			Credit 1.1	Building Reuse—Maintain Existing Walls, Floors, and Roof	1 to 3
			Credit 1.2	Building Reuse—Maintain 50% of Interior Non-Structural Elements	1
			Credit 2	Construction Waste Management	1 to 2
			Credit 3	Materials Reuse	1 to 2
			Credit 4	Recycled Content	1 to 2
			Credit 5	Regional Materials	1 to 2
			Credit 6	Rapidly Renewable Materials	1
			Credit 7	Certified Wood	1

MR Prerequisite 1: Storage and Collection of Recyclables

Required

Intent

Facilitate the reduction of waste generated by building occupants that is hauled to and disposed of in landfills.

Requirement

Provide an easily accessible area that serves the entire building and is dedicated to the separation, collection and storage of materials for recycling including (at a minimum) paper, corrugated cardboard, glass, plastics, and metals.

Feasibility

In most cases, this credit has no construction or soft cost impact. Many buildings already have waste handling areas and procedures, and the incorporation of dedicated recycling areas represents a very small increase in program. In many projects, this is incorporated regardless of the credit.

Potential Technologies, Strategies & Goals

- Designate an area for recyclable collection and storage that is appropriately sized and located in a convenient area.
- Identify local waste handlers and buyers for glass, plastic, metals, office paper, newspaper, cardboard and organic wastes.
- Instruct occupants on recycling procedures.
- Consider employing cardboard balers, aluminum can crushers, recycling chutes and other waste management strategies to further enhance the recycling program.

MR 1-1: Building Reuse – Maintain Existing Walls Floors and Roof

Points Available 1 to 3
DSC Potential Points Achieved 0

Intent

To extend the lifecycle of existing building stock, conserve resources, retain cultural resources, reduce waste and reduce environmental impacts of new buildings as they relate to materials manufacturing and transport.

Requirement

Maintain the existing building structure (including structural floor and roof decking) and envelope (the exterior skin and framing, excluding window assemblies and non-structural roofing material). The minimum percentage building reuse for each point threshold is as follows:

- 55% 1 point
- 75% 2 points
- 95% 3 points

Feasibility

These credits simply require the reuse of specified percentages of a building's fabric. While many projects involve the reuse of existing buildings, few projects incorporate these points. Typically it can be difficult for remodeling projects to achieve other points, particularly site and energy use reduction, without significant increase in cost. These points in themselves do not necessarily add cost to a project; it is the impact of the cost of achieving other necessary points that tends to prohibit remodel projects from achieving LEED.

Potential Technologies, Strategies & Goals

- Reuse of existing building structure, brick and concrete masonry units.
- Remove elements that pose a contamination risk to building occupants and upgrade components that would improve energy and water efficiency such as windows, mechanical systems and plumbing fixtures.

This credit is targeted toward projects that are reusing, restoring, or renovating an existing building. The major consideration will typically be whether a minimum of 55 percent of the structure and shell can be retained. If a modernization or renovation project involves façade re-cladding, or significant demolition to accommodate new additions, the percent preservation criteria may not be viable.

MR 1-2: Building Reuse – Maintain Interior Non-Structural Elements

Points Available 1
DSC Potential Points Achieved 0

Intent

To extend the lifecycle of existing building stock, conserve resources, retain cultural resources, reduce waste and reduce environmental impacts of new buildings as they relate to materials manufacturing and transport.

Requirement

Use existing interior nonstructural elements (e.g., interior walls, doors, floor coverings and ceiling systems) in at least 50% (by area) of the completed building, including additions. If the project includes an addition with square footage more than 2 times the square footage of the existing building, this credit is not applicable.

Feasibility

These credits simply require the reuse of specified percentages of a building's fabric. While many projects involve the reuse of existing buildings, few projects incorporate these points. Typically it can be difficult for remodeling projects to achieve other points, particularly site and energy use reduction, without significant increase in cost. These points in themselves do not necessarily add cost to a project; it is the impact of the cost of achieving other necessary points that tends to prohibit remodel projects from achieving LEED.

Potential Technologies, Strategies & Goals

- Consider reusing existing building structures, envelopes and interior nonstructural elements.
- Remove elements that pose a contamination risk to building occupants, and upgrade components that would improve energy and water efficiency such as mechanical systems and plumbing fixtures.
- Quantify the extent of building reuse.

This credit is considered unlikely for most modernization projects, which involve significant removal of existing interior partitions and finishes. Typically, the projects that could potentially earn this credit are restorations of historical landmarks.

MR 2: Construction Waste Management

Points Available 1 to 2
DSC Potential Points Achieved 2

Intent

To divert construction and demolition debris from disposal in landfills and incineration facilities. Redirect recyclable recovered resources back to the manufacturing process and reusable materials to appropriate sites.

Requirement

- Recycle and/or salvage non-hazardous construction and demolition debris.
- Develop and implement a construction waste management plan that, at a minimum, identifies the materials to be diverted from disposal and whether the materials will be sorted on-site or comingled.

Excavated soil and land-clearing debris do not contribute to this credit. Calculations can be done by weight or volume, but must be consistent throughout. The minimum percentage debris to be recycled or salvaged for each point threshold is as follows:

- 50% 1 point
- 75% 2 points

Feasibility

The ease and cost of compliance with this credit varies greatly by location. In areas where construction waste management is widely used, the costs are minimal, if any. In other areas, or with contractors unfamiliar with construction waste management, the costs can be substantial. While it is increasingly common for contractors to hire a waste hauler to take commingled waste and sort it off-site, many contractors have found that they can actually save costs by sorting waste onsite, if the space is available. In most areas there is no substantial difference between the two points available. Once the contractor has committed to achieving the first point, the second usually follows. The cost premium can be seen in two forms.

- In the first instance there is the direct cost of waste management: developing procedures, training, recycling charges, savings in dump fees, etc.
- The second cost impact is less measurable, and that is the impact on bidders. In periods of high construction demand and limited competition, inexperienced bidders may view these requirements as unduly onerous, and as a result decline to bid, or bid high to cover what they perceive as the risk. This can be mitigated to some degree through bidder outreach and training, but the cost can, nevertheless, be significant in certain locations at periods of low competition.

- Cost impact: Where the contractor can be engaged during the design process, the costs associated with this point can be reduced or eliminated. There should be no additional soft cost, but there will be moderate documentation requirements if the project wishes to demonstrate compliance with the credit.

Potential Technologies, Strategies & Goals

- Establish goals for diversion from disposal in landfills and incineration facilities and adopt a construction waste management plan to achieve these goals.
- Consider recycling cardboard, metal, brick, mineral fiber panel, concrete, plastic, clean wood, glass, gypsum wallboard, carpet and insulation. Construction debris processed into a recycled content commodity that has an open market value (e.g., wood derived fuel

[WDF], alternative daily cover material, etc.) may be applied to the construction waste calculation.

- Designate a specific area(s) on the construction site for segregated or comingled collection of recyclable materials, and track recycling efforts throughout the construction process. Identify construction haulers and recyclers to handle the designated materials. Note that diversion may include donation of materials to charitable organizations and salvage of materials on-site.

MR 3: Materials Reuse

Points Available 1 to 2
DSC Potential Points Achieved 0

Intent

To reuse building materials and products to reduce demand for virgin materials and reduce waste, thereby lessening impacts associated with the extraction and processing of virgin resources.

Requirement

Use salvaged, refurbished or reused materials, the sum of which constitutes at least 5% or 10%, based on cost, of the total value of materials on the project. The minimum percentage materials reused for each point threshold is as follows:

- 5% 1 point
- 10% 2 points

Feasibility

These credits are usually not readily achievable, primarily because, for most buildings, there is not enough opportunity for use of salvaged, refurbished or reused materials, products or furnishings to meet the 5 percent or 10 percent thresholds. Even though some reclaimed materials or products can be incorporated at low cost or even for a reduction in cost, the cost for compliance with these credits can be significant since the percentage thresholds are quite high. Achievement of this credit may not be achievable for all but a very few projects.

Potential Technologies, Strategies & Goals

- Identify opportunities to incorporate salvaged materials into the building design, and research potential material suppliers.
- Consider salvaged materials such as beams and posts, flooring, paneling, doors and frames, cabinetry and furniture, brick, and decorative items.

MR 4: Recycled Content

Points Available 1 to 2
DSC Potential Points Achieved 2

Intent

To increase demand for building products that incorporate recycled content materials, thereby reducing impacts resulting from extraction and processing of virgin materials.

Requirement

Use materials with recycled content such that the sum of post-consumer recycled content plus 1/2 of the pre-consumer Recycled Content constitutes at least 10% or 20%, based on cost, of the total value of the materials in the project. The minimum percentage materials recycled for each point threshold is as follows;

- 10% 1 point
- 20% 2 points

Feasibility

The use of recycled content is usually not difficult for most projects, and can be done at minimal or no added cost. Most buildings qualify for at least one point for recycled content with no additional cost impact, and minimal or no design effort (projects typically use standard construction materials that already have high recycled content.) The second point can be challenging, however, since the thresholds (20 percent by value) are quite high, and concentrated effort is needed to identify high recycled content materials to replace more standard products. There should be no additional soft cost, but there will be significant documentation requirements should the owner wish to demonstrate compliance with this credit. Documentation involves tracking recycled content materials. This can be done with a simple one-page form that each trade is required to fill out for each product. Product manufacturers are familiar with this requirement and often provide recycled content data whether or not it has been requested. Trades are also being asked to isolate the cost for materials, separate of labor and other costs. Once the general contractor has set up a tracking document and process, the added labor is not significant.

Potential Technologies, Strategies & Goals

- Establish a project goal for recycled content materials, and identify material suppliers that can achieve this goal.
- During construction, ensure that the specified recycled content materials are installed.
- Consider a range of environmental, economic and performance attributes when selecting products and materials.

The EPA's (US Environmental Protection Agency) Comprehensive Procurement Guidelines (CPG) identify a number of available recycled-content materials, and designate the minimum levels of recycled content that should be specified for construction materials. Examples of CPG items include:

- Building insulation products
- Carpet (PET fiber)
- Carpet cushion
- Concrete containing coal fly ash or ground granulated blast furnace slag
- Consolidated and reprocessed latex paint
- Floor tiles
- Flowable fill
- Laminated paperboard
- Patio blocks
- Shower and restroom dividers/partitions

• Structural fiberboard

In addition to CPG-targeted materials, a number of other commonly used building products incorporate recycled content as standard industry practice. Examples of these materials include:

• Steel (including structural shapes, cold formed framing, reinforcing bar, doors and fames, and most steel accessories)
• Mineral-fiber-based acoustical ceiling tiles
• Mineral-fiber-based, spray-applied fireproofing
• Wood particleboard and medium density fiberboard (mdf)
• Gypsum wallboard (paper facings)

MR 5: Regional Materials

Points Available 1 to 2
DSC Potential Points Achieved 2

Intent

To increase demand for building materials and products that are extracted and manufactured within the region, thereby supporting the use of indigenous resources and reducing the environmental impacts resulting from transportation.

Requirement

Use building materials or products that have been extracted, harvested or recovered, as well as manufactured, within 500 miles of the project site for a minimum of 10% or 20%, based on cost, of the total materials value. If only a fraction of a product or material is extracted, harvested, or recovered and manufactured locally, then only that percentage (by weight) can contribute to the regional value. The minimum percentage of regional materials for each point threshold is as follows:

- 10% 1 point
- 20% 2 points

Feasibility

With the modifications made to this requirement under LEED 2.2, which added the requirement for local extraction as well as local manufacture, this credit became very difficult to achieve, even in areas with strong local manufacturing bases.

- Cost impact: It is difficult to assess what the cost implications might be, since strategies to achieve could have major impacts on the approach to basic design and structure of each project.

Potential Technologies, Strategies & Goals

- Minimize manufacturing and transportation energy inputs
- Establish a project goal for locally sourced materials, and identify materials and material suppliers that can achieve this goal.
- During construction, ensure that the specified local materials are installed, and quantify the total percentage of local materials installed.
- Consider a range of environmental, economic and performance attributes when selecting products and materials.

MR 6: Rapidly Renewable Materials

Points Available 1
DSC Potential Points Achieved 1

Intent

To reduce the use and depletion of finite raw materials and long-cycle renewable materials by replacing them with rapidly renewable materials.

Requirement

Use rapidly renewable building materials and products for 2.5% of the total value of all building materials and products used in the project, based on cost. Rapidly renewable building materials and products are made from plants that are typically harvested within a 10-year or shorter cycle.

Feasibility

Even though some rapidly renewable materials can be incorporated at low cost, the cost for compliance with these credits can be significant, since the percentage threshold is quite high for most projects, and it can be difficult to find sufficient suitable materials to comply with this credit . For many projects, the obstacle is not the cost of renewable materials, but the feasibility of identifying enough materials to meet the required threshold. For this reason, the compliance threshold has been lowered in LEED 2.2, making this credit more achievable.

- Cost impact: There should be no additional soft cost but there will be significant documentation requirements.

Potential Technologies, Strategies & Goals

- Establish a project goal for rapidly renewable materials, and identify products and suppliers that can support achievement of this goal.
- Consider materials such as bamboo, wool, cotton insulation, agrifiber, linoleum, wheatboard, strawboard and cork.
- During construction, ensure that the specified renewable materials are installed.

MR 7: Certified Wood

Points Available 1
DSC Potential Points Achieved 1

Intent

To encourage environmentally responsible forest management.

Requirement

Use a minimum of 50% (based on cost) of wood-based materials and products that are certified in accordance with the FSC's (Forest Stewardship Council) principles and criteria, for wood building components. These components include at a minimum, structural framing and general dimensional framing, flooring, sub-flooring, wood doors and finishes.

Feasibility

The cost of certified wood varies widely with location and timing, and is dependent primarily on supply and demand. Project teams should continually monitor supply and price and consider making a final decision as close to bid as possible. For buildings using certified wood only in finished carpentry, and in areas where there is more than one supplier, the cost premium is minimal.

Potential Technologies, Strategies & Goals

- Establish a project goal for FSC-certified wood products
- Maximize use of wood and natural materials.
- Identify suppliers that can achieve this goal.
- During construction, ensure that the FSC-certified wood products are installed and quantify the total percentage of FSC-certified wood products installed.

LEED® 2009 for New Construction & Major Renovations
Environmental Quality

Points Available 15
DSC Potential Points Achieved 14

Indoor Environmental Quality is the most popular section for credit achievement, with many of the credits well represented in all projects.

				Indoor Environmental Quality	**Possible Points: 15**
Y			Prereq 1	Minimum Indoor Air Quality Performance	
Y			Prereq 2	Environmental Tobacco Smoke (ETS) Control	
			Credit 1	Outdoor Air Delivery Monitoring	1
			Credit 2	Increased Ventilation	1
			Credit 3.1	Construction IAQ Management Plan—During Construction	1
			Credit 3.2	Construction IAQ Management Plan—Before Occupancy	1
			Credit 4.1	Low-Emitting Materials—Adhesives and Sealants	1
			Credit 4.2	Low-Emitting Materials—Paints and Coatings	1
			Credit 4.3	Low-Emitting Materials—Flooring Systems	1
			Credit 4.4	Low-Emitting Materials—Composite Wood and Agrifiber Products	1
			Credit 5	Indoor Chemical and Pollutant Source Control	1
			Credit 6.1	Controllability of Systems—Lighting	1
			Credit 6.2	Controllability of Systems—Thermal Comfort	1
			Credit 7.1	Thermal Comfort—Design	1
			Credit 7.2	Thermal Comfort—Verification	1
			Credit 8.1	Daylight and Views—Daylight	1
			Credit 8.2	Daylight and Views—Views	1

EQ Prerequisite 1: Minimum IAQ Performance

Required

Intent

To establish minimum indoor air quality (IAQ) performance to enhance indoor air quality in buildings, thus contributing to the comfort and well-being of the occupants.

Requirement

Meet the minimum requirements of Sections 4 through 7 of ASHRAE Standard 62.1 and;

- Case 1. Mechanically Ventilated Spaces Mechanical ventilation systems must be designed using the ventilation rate procedure or the applicable local code, whichever is more stringent.

Or

- Case 2. Naturally Ventilated Spaces Naturally ventilated buildings must comply with ASHRAE Standard 62.1

Feasibility

In most cases, this prerequisite has no construction or soft cost impact. The standards and technologies required for this point are standard to most projects. The documentation requirements are not onerous.

Potential Technologies, Strategies & Goals

- Design ventilation systems to meet or exceed the minimum outdoor air ventilation rates as described in the ASHRAE standard.
- Balance the impacts of ventilation rates on energy use and indoor air quality to optimize for energy efficiency and occupant comfort.

EQ Prerequisite 2: Environmental Tobacco Smoke (ETS) Control
Required

Intent
To prevent or minimize exposure of building occupants, indoor surfaces and ventilation air distribution systems to environmental tobacco smoke (ETS).

Requirement
Prohibit smoking in the building. Prohibit on-property smoking within 25 feet of entries, outdoor air intakes and operable windows. Provide signage to allow smoking in designated areas, prohibit smoking in designated areas or prohibit smoking on the entire property.

Feasibility
The simplest way to achieve this credit is to eliminate smoking in the building; with this approach there is no added construction cost. If smoking is permitted, the cost to provide designated smoking areas with adequate ventilation systems range from moderate to substantial. In most cases, this prerequisite has very little construction or soft cost impact. The standards and technologies required are standard to most projects or easily achieved at minimal added cost.

Potential Technologies, Strategies & Goals
- Prohibit smoking in commercial buildings or;
- Effectively control the ventilation air in smoking rooms.

EQ 1: Outdoor Air Delivery Monitoring

Possible Points 1

Intent

To provide capacity for ventilation system monitoring to help promote occupant comfort and well-being

Requirement

Install permanent monitoring systems to ensure that ventilation systems maintain design minimum requirements. Configure all monitoring equipment to generate an alarm when airflow values or carbon dioxide (CO2) levels vary by 10% or more from the design values via either a building automation system alarm to the building operator or a visual or audible alert to the building occupants and;

- Case 1. Mechanically Ventilated Spaces Mechanical ventilation systems must be designed using the ventilation rate procedure or the applicable local code, whichever is more stringent.

Or

- Case 2. Naturally Ventilated Spaces Naturally ventilated buildings must comply with ASHRAE Standard 62.1

Feasibility

In most cases, this credit has little construction or soft cost impact. The added sensors and the modifications to the control systems make a very small contribution to the overall cost of the air conditioning systems. The standards and technologies required for this point are standard to most projects or easily achieved at minimal added cost.

Potential Technologies, Strategies & Goals

- The building management system will use the measurement equipment to trigger alarms that inform building operators or occupants of a possible deficiency in outdoor air delivery.

EQ 2: Increase Ventilation

Points Available 1
DSC Potential Points Achieved 1

Intent

To provide additional outdoor air ventilation to improve indoor air quality (IAQ) and promote occupant comfort, well-being and productivity.

Requirement

- Case 1. Mechanically Ventilated Spaces - Increase breathing zone outdoor air ventilation rates to all occupied spaces by at least 30% above the minimum rates required by ASHRAE Standard 62.1-2007.
- Case 2. Naturally Ventilated Spaces - Determine that natural ventilation is an effective strategy for the project by following the flow diagram process shown in Figure 2.8 of the CIBSE Applications Manual 10: 2005, Natural Ventilation in Non-domestic Buildings.

And;

- Option 1 - Show that the natural ventilation systems design meets the recommendations set forth in the CIBSE manuals appropriate to the project space.
    - PATH 1 CIBSE Applications Manual - Natural Ventilation in Non-domestic Buildings, or;
    - PATH 2 CIBSE Mixed Mode Ventilation

Or;

- Option 2 Use a macroscopic, multizone, analytic model to predict that room-by-room airflows will effectively naturally ventilate, defined as providing the minimum ventilation rates required by ASHRAE 62.1-2007

Feasibility

Compliance with this credit has a very small construction cost impact, whether through the use of operable windows for natural ventilation or through the increased use of outside air in mechanical ventilation systems, but can have a significant impact on the operational cost of the facility, particularly in areas where the outside air temperature or humidity is significantly different from the required indoor conditions. Increasing outdoor air through the use of natural ventilation can have an impact on mechanical system controls, as well as on fenestration costs. Increasing outdoor air quantities in mechanical ventilation systems will usually lead to increased coil sizes, and possibly increased chilling and heating plant capacity. The increased operational costs can be offset to some degree through the use of total heat recovery.

Potential Technologies, Strategies & Goals

- For naturally ventilated spaces, follow the 8 design steps described in the Carbon Trust Good Practice Guide 237;
    - Develop design requirements.
    - Plan airflow paths
    - Identify building uses and features that might require special attention.
    - Determine ventilation requirements.
    - Estimate external driving pressures.
    - Select types of ventilation devices.
    - Size ventilation devices.
    - Analyze the design.

EQ 3-1: Construction IAQ Management Plan – During Construction

Points Available 1
DSC Potential Points Achieved 1

Intent

To reduce indoor air quality (IAQ) problems resulting from construction or renovation and promote the comfort and well-being of construction workers and building occupants.

Requirement

Develop and implement an IAQ management plan for the construction and preoccupancy phases of the building as follows:

- During construction, meet or exceed the recommended control measures of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines For Occupied Buildings Under Construction
- Protect stored on-site and installed absorptive materials from moisture damage.
- If permanently installed air handlers are used during construction, filtration media with a minimum efficiency reporting value (MERV) of 8 must be used at each return air grille. Replace all filtration media immediately prior to occupancy.

Feasibility

This credit is one that many projects aim for. Even though acceptance of these requirements is growing within the construction community, it can be difficult to achieve because the credit requires significant coordination and management on the part of the contractor and all members of the construction crew, as well as a strong commitment by all members of the construction crew to abide by the rules. The ease and cost of compliance with this credit varies greatly by location. In areas where construction IAQ management is widely used, the costs are minimal, if any. In other areas or with contractors unfamiliar with construction IAQ management the costs can be substantial. The cost premium can be seen in two forms. In the first instance there is the direct cost of IAQ management: developing procedures, training, material handling, etc. The second cost impact is less measurable, and that is the impact on bidders. In periods of high construction demand and limited competition, inexperienced bidders may view these requirements as unduly onerous, and as a result decline to bid, or bid high to cover what they perceive as the risk. This can be mitigated to some degree through bidder outreach and training, but the cost can be significant in certain locations at periods of low competition. There should be minimal additional soft cost, mainly related to collaboration with the contractor in developing and overseeing the operation of the IAQ plan, but there will be moderate documentation requirements in order to monitor and demonstrate compliance.

Potential Technologies, Strategies & Goals

- Adopt an IAQ management plan to protect the heating, ventilating and air conditioning (HVAC) system during construction, control pollutant sources and interrupt contamination pathways.
- Sequence the installation of materials to avoid contamination of absorptive materials, such as insulation, carpeting, ceiling tile and gypsum wallboard.
- Coordinate with IEQ Credit 3.2: Construction IAQ Management Plan — Before Occupancy and IEQ Credit 5: Indoor Chemical & Pollutant Source Control to determine the appropriate specifications and schedules for filtration media.
- If possible, avoid using permanently installed air handlers for temporary heating/cooling during construction.

EQ 3-2: Construction IAQ Management Plan - Before Occupancy

Points Available 1
DSC Potential Points Achieved 1

Intent

To reduce indoor air quality (IAQ) problems resulting from construction or renovation to promote the comfort and well-being of construction workers and building occupants.

Requirement

Develop an IAQ management plan and implement it after all finishes have been installed and the building has been completely cleaned before occupancy.

- Option 1 - Flush-Out
- Option 2 – Air Testing

Feasibility

The feasibility of this credit has changed under LEED 2.2, since it now allows for testing as an alternative to a building flush out, and the flush out requirement is no longer two weeks at 100% outside air. As a result of the change, more projects are considering pursuing this credit. In hot, dry areas a two week flush-out with outdoor air is quite feasible as long as it is planned into the construction schedule. In areas where there is high humidity, however, flushing out is difficult in certain seasons, since a flush-out with outdoor air in wetter climates is more likely to expose the interior of the building to mold and other problems.

- Cost impact: The costs for flush out are usually very small, in the range of $0.25 to $0.50/SF, but the schedule impact may not be acceptable. The costs for testing are minimal, usually a few thousand dollars per area. For most buildings, there will be a limited number of areas, with test areas usually in the range of 10,000 to 20,000 SF.

Potential Technologies, Strategies & Goals

- Prior to occupancy, perform a building flush-out or test the air contaminant levels in the building. The intent of this credit is to eliminate IAQ problems that occur as a result of construction.

EQ 4: Low Emitting Materials

EQ 4-1: Adhesives and Sealants
EQ 4-2: Paints and Coatings
EQ 4-3: Carpet Systems
EQ 4-4: Composite Wood and Agrifiber Products

Points Available 1 each (4 total)
DSC Potential Points Achieved 3

Intent

To reduce the quantity of indoor air contaminants that are odorous, irritating and/or harmful to the comfort and well-being of installers and occupants.

Requirement

EQ 4-1: Adhesives and Sealants

Adhesives, Sealants and Sealant Primers must comply with South Coast Air Quality Management District (SCAQMD) Rule #1168. Volatile organic compound (VOC) limits.

EQ 4-2: Paints and Coatings

Architectural paints and coatings applied to interior walls and ceilings must not exceed the volatile organic compound (VOC) content limits established in Green Seal Standard GS-11, Paints

EQ 4-3: Carpet Systems

All flooring must comply with the following as applicable to the project scope:

- All carpet installed in the building interior must meet the testing and product requirements of the Carpet and Rug Institute Green Label Plus32 program.
- All carpet cushion installed in the building interior must meet the requirements of the Carpet and Rug Institute Green Label program.
- All carpet adhesive must meet the requirements of IEQ Credit 4.1: Adhesives and Sealants
- All hard surface flooring must meet the requirements of the FloorScore standard
- Concrete, wood, bamboo and cork floor finishes such as sealer, stain and finish must meet the requirements of South Coast Air Quality Management District
- Tile setting adhesives and grout must meet South Coast Air Quality Management District

EQ 4-4: Composite Wood and Agrifiber Products

Composite wood and agrifiber products used on the interior of the building (i.e., inside the weatherproofing system) must contain no added urea-formaldehyde resins. Laminating adhesives used to fabricate on-site and shop-applied composite wood and agrifiber assemblies must not contain added urea-formaldehyde resins.

Feasibility

The first three of these credits are fairly easy to achieve. In some cases, local or regional ordinances may already require that projects meet the required standards. Where local or regional regulations do not already establish the use of low emitting materials, making use of these should have only minimal – if any – impact on cost, as these are usually widely available. The requirement for composite wood and agrifiber products can be harder to achieve, as suitable products are less readily available. In most cases, these credits have no construction or soft cost impact. The technologies required for these points are standard to most projects, or easily achieved at minimal added cost. The one exception is EQ 4-4: Composite Wood and Agrifiber Products. Prices for composite wood materials with no added urea-formaldehyde can vary widely, depending on the product selected and market conditions. Documentation of the use of materials is a concern for contractors. Some states are considering banning building materials with added urea-formaldehyde; this should have a positive impact on costs.

Potential Technologies, Strategies & Goals

EQ 4-1: Adhesives and Sealants

- Specify low-VOC materials in construction documents. Ensure that VOC limits are clearly stated in each section of the specifications where adhesives and sealants are addressed. Common products to evaluate include;
    - general construction adhesives
    - flooring adhesives
    - fire-stopping sealants
    - caulking, duct sealants
    - plumbing adhesives
    - cove base adhesives.

EQ 4-2: Paints and Coatings

- Specify low-VOC paints and coatings in construction documents.
- Ensure that VOC limits are clearly stated in each section of the specifications where paints and coatings are addressed.
- Track the VOC content of all interior paints and coatings during construction.

EQ 4-3: Carpet Systems

- Clearly specify requirements for product testing and/or certification in the construction documents.
- Select products that are either certified under the Green Label Plus program or for which testing has been done by qualified independent laboratories in accordance with the appropriate requirements.

EQ 4-4: Composite Wood and Agrifiber Products

- Specify wood and agrifiber products that contain no added urea-formaldehyde resins.
- Specify laminating adhesives for field and shop-applied assemblies that contain no added urea-formaldehyde resins.
- Review product cut sheets, material safety data (MSD) sheets, signed attestations or other official literature from the manufacturer.

EQ 5: Indoor Chemical and Pollutant Source Control

Points Available 1
DSC Potential Points Achieved 1

Intent

To minimize building occupant exposure to potentially hazardous particulates and chemical pollutants.

Requirement

Design to minimize pollutant cross-contamination of regularly occupied areas:

- Employ permanent entry way systems (grills, grates, etc.) to capture dirt, particulates, etc. from entering the building at all high volume entryways.
- Where chemical use occurs (including housekeeping areas and copying/printing rooms), provide segregated areas with deck to deck partitions with separate outside exhaust at a rate of at least 0.50 cubic feet per minute per square foot, no air recirculation and maintaining a negative pressure of at least 7 PA (0.03 inches of water gauge).
- Provide drains plumbed for appropriate disposal of liquid waste in spaces where water and chemical concentrate mixing occurs.

Feasibility

This credit is usually fairly easy to achieve with little added cost. Entry grates carry minimal costs, unless the building has multiple entries. In most cases, requirements for chemical mixing areas are already in the design. The use of MERV 13 filters usually represents a minimal added cost if any (many projects already require this as good practice). In smaller projects with small or package systems, it may not be possible to add the filters. In most cases, this credit has minor construction and no soft cost impact.

Potential Technologies, Strategies & Goals

- Design facility cleaning and maintenance areas with isolated exhaust systems for contaminants.
- Maintain physical isolation from the rest of the regularly occupied areas of the building. Install permanent architectural entryway systems such as grills or grates to prevent occupant-borne contaminants from entering the building.
- Install high-level filtration systems in air handling units processing both return air and outside supply air.
- Ensure that air handling units can accommodate required filter sizes and pressure drops.
- Design a living / breathing wall to filter air pollutants and oxygenate interior working environments.
- Select construction finishes that emit low or zero emissions, minimizing interior contaminants and poor IAQ.

EQ 6-1: Controllability of Systems – Lighting

Points Available 1
DSC Potential Points Achieved 1

Intent

To provide a high level of lighting system control by individual occupants or groups in multi-occupant spaces (e.g., classrooms and conference areas) and promote their productivity, comfort and well-being.

Requirement

Provide individual lighting controls for 90% (minimum) of the building occupants to enable adjustments to suit individual task needs and preferences
Provide lighting system controls for all shared multi-occupant spaces to enable adjustments that meet group needs and preferences.

Feasibility

With the changes that came with LEED 2.2, this point can be easily achieved in most projects. The cost impact comes from enhanced lighting controls, which are increasingly being incorporated as part of the energy efficiency strategies implemented by projects. These costs can range from minimal to significant.

Potential Technologies, Strategies & Goals

- Design the building with occupant controls for lighting. Strategies to consider include;
    - lighting controls and task lighting.

- Integrate lighting systems controllability into the overall lighting design, providing ambient and task lighting while managing the overall energy use of the building.
- Maximize the hours of operation and use of the building zone
- Maximize operations and density of use

EQ 6-2: Controllability of Systems –Thermal Comfort

Points Available 1
DSC Potential Points Achieved 1

Intent

Provide individual lighting controls for 90% (minimum) of the building occupants to enable adjustments to suit individual task needs and preferences

Requirement

Provide individual comfort controls for 50% (minimum) of the building occupants to enable adjustments to meet individual needs and preferences. Operable windows may be used in lieu of controls for occupants located 20 feet inside and 10 feet to either side of the operable part of a window. The areas of operable window must meet the requirements of ASHRAE Standard 62.1. Provide comfort system controls for all shared multi-occupant spaces to enable adjustments that meet group needs and preferences.

Feasibility

Where areas are under the control of the single occupants, the cost of controlling thermal comfort can be fairly high, since it includes not only the control point, but also control valves on the air or hydronic supply to the space. These can be expensive in most conventional systems, although when integrated into more sophisticated or carefully planned systems, the cost per control can be significantly lower. This point is achieved in projects with VAV, radiant panels, or displacement air systems.

Potential Technologies, Strategies & Goals

- Design the building and systems with comfort controls to allow adjustments to suit individual needs or those of groups in shared spaces
- Control strategies can be developed to expand on the comfort criteria and enable individuals to make adjustments to suit their needs and preferences. These strategies may involve system designs incorporating
    - Operable windows
    - Hybrid systems integrating operable windows and mechanical systems
    - Mechanical systems alone

  Individual adjustments may involve;
    - Individual thermostat controls
    - Local diffusers at floor, desk or overhead levels,
    - Control of individual radiant panels or other means integrated into the overall building, thermal comfort systems and energy systems design.

EQ 7-1: Thermal Comfort – Design

Points Available 1
DSC Potential Points Achieved 1

Intent

To provide a comfortable thermal environment that promotes occupant productivity and well-being.

Requirement

Design heating, ventilating and air conditioning (HVAC) systems and the building envelope to meet the requirements of ASHRAE Standard 55-2004, Thermal Comfort Conditions for Human Occupancy.

Feasibility

Most projects are designed to comply with ASHRAE comfort standards, and meet requirements for no added cost. The point is not easily achieved in projects with smaller systems, or that are trying to reduce energy usage by relaxing comfort standards.

Potential Technologies, Strategies & Goals

- Establish comfort criteria according to ASHRAE 55-2004 that support the desired quality and occupant satisfaction with building performance.
- Design the building envelope and systems with the capability to meet the comfort criteria under expected environmental and use conditions.
- Evaluate air temperature, radiant temperature, air speed and relative humidity in an integrated fashion, and coordinate these criteria with IEQ Prerequisite 1: Minimum IAQ Performance, IEQ Credit 1: Outdoor Air Delivery Monitoring, and IEQ Credit 2: Increased Ventilation.

EQ 7-2: Thermal Comfort – Verification

Points Available 1
DSC Potential Points Achieved 1

Intent

To provide for the assessment of building occupant thermal comfort over time.

Requirement

- Achieve IEQ Credit 7.1: Thermal Comfort—Design
- Provide a permanent monitoring system to ensure that building performance meets the desired comfort criteria as determined by IEQ Credit 7.1: Thermal Comfort—Design.
- Agree to conduct a thermal comfort survey of building occupants within 6 to 18 months after occupancy. This survey should collect anonymous responses about thermal comfort in the building, including an assessment of overall satisfaction with thermal performance and identification of thermal comfort-related problems.
- Agree to develop a plan for corrective action if the survey results indicate that more than 20% of occupants are dissatisfied with thermal comfort in the building. This plan should include measurement of relevant environmental variables in problem areas in accordance with ASHRAE Standard 55

Feasibility

This point is easily achieved in LEED 2.2. The costs associated with preparing a survey of building occupants are moderate. There are no implications to soft costs. Many owners, however, choose not to pursue this credit, from reluctance to survey occupants.

Potential Technologies, Strategies & Goals

- ASHRAE 55-2004 provides guidance for establishing thermal comfort criteria and documenting and validating building performance to the criteria. While the standard is not intended for purposes of continuous monitoring and maintenance of the thermal environment, the principles expressed in the standard provide a basis for the design of monitoring and corrective action systems.

EQ 8-1: Daylight

Points Available 1
DSC Potential Points Achieved 1

Intent

To provide building occupants with a connection between indoor spaces and the outdoors through the introduction of daylight and views into the regularly occupied areas of the building.

Requirement

Achieve daylighting in at least 75% of regularly occupied spaces.

Feasibility

There are two main elements in the strategy to achieve this point. The first is to reduce the maximum distance from the exterior by narrowing the floor plate as far as possible. The second is to maximize the daylight penetration into the building by the use of good orientation, high quality glazing, and effective light shelving. In many projects, the floor plate size is set by program, and it can be challenging to reduce the overall depth of the floor plate. In other projects, such as office buildings, it is generally easier to configure the floor plates to allow for greater daylight penetration. Even so, it can be difficult to get enough daylight to achieve compliance. Costs associated with this point are usually for high performance glazing and/or increased glazing opening sizes, and can range from minimal to significant.

Potential Technologies, Strategies & Goals

- Design the building to maximize interior daylighting. Strategies to consider include
  - building orientation
  - shallow floor plates
  - increased building perimeter
  - exterior and interior permanent shading devices
  - high-performance glazing
  - high-ceiling reflectance values
  - integrate light tubes, solar reflectors and mesooptic technology to achieve daylighting goals.
  - use light shelves to penetrate daylight deep into the building interior
- Additionally, automatic photocell-based controls can help to reduce energy use.
- Use high efficiency lighting (LED, T5)
- Predict daylight factors via manual calculations or model daylighting strategies with a physical or computer model to assess footcandle levels and daylight factors achieved
- Design interior work spaces to be 100% daylit by harnessing daylight from perimeter windows, clerestories, skylights, and light wells.

EQ 8-2: Views

Points Available 1
DSC Potential Points Achieved 1

Intent

To provide building occupants a connection to the outdoors through the introduction of daylight and views into the regularly occupied areas of the building.

Requirement

Achieve a direct line of sight to the outdoor environment via vision glazing between 30 inches and 90 inches above the finish floor for building occupants in 90% of all regularly occupied areas. Determine the area with a direct line of sight by totaling the regularly occupied square footage that meets the following criteria:

- In plan view, the area is within sight lines drawn from perimeter vision glazing.
- In section view, a direct sight line can be drawn from the area to perimeter vision glazing.

The line of sight may be drawn through interior glazing. For private offices, the entire square footage of the office may be counted if 75% or more of the area has a direct line of sight to perimeter vision glazing. For multi-occupant spaces, the actual square footage with a direct line of sight to perimeter vision glazing is counted.

Feasibility

This point is usually achievable by the thoughtful arrangement of interior spaces, and the addition of glazing at interior partitions. Costs are minimal to moderate.

Potential Technologies, Strategies & Goals

- Design the space to maximize daylighting and view opportunities. Strategies to consider include
  - Lower partitions
  - Interior shading devices
  - Interior glazing
  - Automatic photocell-based controls.

LEED® 2009 for New Construction & Major Renovations
Innovation and Design Process

Points Available 6
DSC Potential Points Achieved 6

Most projects seek at least two Innovation in Design credits, plus the credit for having a LEED accredited professional on the project. The innovation credits come from two main sources:

- Exceeding thresholds in other credits, for example diverting 95 percent of waste from landfill, higher levels of recycled materials, or significantly higher use of public transit systems.
- Incorporating innovative environmental strategies not covered by other credits. These can include, among many options:
    - Developing an environmental educational program or community outreach program using the building. This requires a specific educational program, and not simply a passive 'poster' display.
    - Incorporation of green housekeeping strategies.
    - Extension of Materials and Resources credit requirements to Furnishings, Fixtures or Equipment (FF&E).
    - Use of extended Labs or Green Guide for Healthcare criteria where appropriate, or adoption of other LEED system requirements, such as LEED for Neighborhood Development credits.
    - Preconstruction surveys of other similar buildings to establish actual baseline performance, leading to right sizing of equipment.

			Innovation and Design Process	**Possible Points: 6**
			Credit 1.1	Innovation in Design: Specific Title 1
			Credit 1.2	Innovation in Design: Specific Title 1
			Credit 1.3	Innovation in Design: Specific Title 1
			Credit 1.4	Innovation in Design: Specific Title 1
			Credit 1.5	Innovation in Design: Specific Title 1
			Credit 2	LEED Accredited Professional 1

Potential Technologies, Strategies & Goals

- Substantially exceed a LEED 2009 for New Construction and Major Renovations performance credit such as energy performance or water efficiency.
- Apply strategies or measures that demonstrate a comprehensive approach and quantifiable environment and/or health benefits.

LEED® 2009 for New Construction & Major Renovations
Regional Priority Credits

Points Available 4
DSC Potential Points Achieved 4

		Regional Priority Credits	**Possible Points: 4**
	Credit 1.1	Regional Priority: Specific Credit	1
	Credit 1.2	Regional Priority: Specific Credit	1
	Credit 1.3	Regional Priority: Specific Credit	1
	Credit 1.4	Regional Priority: Specific Credit	1

Intent
To provide an incentive for the achievement of credits that address geographically-specific environmental priorities.

Requirements
Earn 1-4 of the 6 Regional Priority credits identified by the USGBC regional councils and chapters as having environmental importance for a project's region. A database of Regional Priority credits and their geographic applicability is available on the USGBC website, http://www.usgbc.org.

One point is awarded for each Regional Priority credit achieved; no more than 4 credits identified as Regional Priority credits may be earned. Projects outside of the U.S. are not eligible for Regional Priority credits.

Zip Code 48204

Regional Credits

- SSc3
- SSc4.1
- SSc4.2
- SSc6.2
- SSc7.2
- MRc1.1 (75%)

Potential Technologies, Strategies & Goals
Determine and pursue the prioritized credits for the project location.

Sources referenced
Leed 2009 for New Construction and Major Renovations Rating System; U.S. Green Building Council Inc, 2009

U.S. General Services Administration LEED Cost Study – Final Report; GSA|Steven Winter Associates Inc, 2004

Cost of Green Revisited: Reexamining the Feasibility and Cost Impact of Sustainable Design in the Light of Increased Market Adoption; Davis Langon, 2007

CIRS Integrated Design Process Case Study – Final Report; Center for Interactive Research on Sustainability (CIRS), 2008

Appendix 12
Building Construction Estimate

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03 Dec 2010 **DWEJ - Detroit Sustainability Center** **4:27:18PM**

Level 1 Direct Cost Summary **DWEJ Detroit Sustainability Center - Estimate of Probable Costs**

	Quantity	Unit Cost	Total Cost
2010.1864.00 DWEJ - Detroit Sustainability Center			
A GENERAL REQUIREMENTS			$7,503
B SITEWORK			$1,198,162
C BUILDING	16,536 SF	$219.36	$3,627,281
SUBTOTAL	*16,536 SF*	*$292.27*	*$4,832,946*
Contractor's Gen Requirements	10.0%	$29.23	$483,295
Contractor's Overhead	5.0%	$16.07	$265,812
Contractor's Profit	7.0%	$23.63	$390,744
SUBTOTAL	*16,536 SF*	*$361.20*	*$5,972,796*
Design Contingency	17.0%	$61.40	$1,015,375
Sustainable Design Contingency	3.0%	$12.68	$209,645
Architect/ Eng & Sustainable Fees	10.5%	$45.70	$755,771
DWEJ - Detroit Sustainability Center	**16,536 SF**	**$480.99**	**$7,953,588**

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03 Dec 2010 **DWEJ - Detroit Sustainability Center** **4:27:18PM**

Level 3 Direct Cost Summary **DWEJ Detroit Sustainability Center - Estimate of Probable Costs**

	Quantity	Unit Cost	Total Cost
2010.1864.00 DWEJ - Detroit Sustainability Center			
A GENERAL REQUIREMENTS			
SURVEY			$4,208
GEOTECHNICAL			$3,296
SUBTOTAL GENERAL REQUIREMENTS			$7,503
B SITEWORK			
G10 SITE PREPARATION			
2010 SITE DEMOLITION			$20,027
2015 SITE ENVIRONMENTAL			$172,730
SUBTOTAL SITE PREPARATION			$192,757
G20 SITE IMPROVEMENTS			
2020 ROADWAY EDGES			$23,669
2030 PEDESTRIAN PAVING			$436,450
2040 SITE DEVELOPMENT			$336,070
2050 LANDSCAPING			$146,000
SUBTOTAL SITE IMPROVEMENTS			$942,190
G30 SITE MECHANICAL UTILITIES			
3010 WATER SUPPLY			$11,150
3020 SANITARY SEWER			$2,778
3030 STORM SEWER			$9,766
SUBTOTAL SITE MECHANICAL UTILITIES			$23,694
G40 SITE ELECTRICAL UTILITIES			
4010 ELECTRICAL DISTRIBUTION			$5,922
4020 SITE LIGHTING			$33,600
SUBTOTAL SITE ELECTRICAL UTILITIES			$39,522
SUBTOTAL SITEWORK			$1,198,162
C BUILDING			
B1 DEMOLITION & REMEDIATION			
5010 Selective Building Demolition			$90,819
5020 Environmental Remediation			$94,371
SUBTOTAL DEMOLITION & REMEDIATION			$185,189
B2 FOUNDATIONS & FLATWORK			
5030 FOUNDATIONS	16,536 SF	$1.73	$28,647
5040 FLATWORK			$119,942
SUBTOTAL FOUNDATIONS & FLATWORK	16,536 SF	$8.99	$148,590
B3 BUILDING SHELL			
5060 STRUCTURAL FRAMING	16,536 SF	$21.88	$361,874
5070 EXTERIOR ENCLOSURE	16,536 SF	$38.67	$639,446
5080 ROOFING	16,536 SF	$14.96	$247,310
SUBTOTAL BUILDING SHELL	16,536 SF	$75.51	$1,248,631
B4 INTERIORS			

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03 Dec 2010 **DWEJ - Detroit Sustainability Center** **4:27:18PM**

Level 3 Direct Cost Summary **DWEJ Detroit Sustainability Center - Estimate of Probable Costs**

	Quantity	Unit Cost	Total Cost
6010 INTERIOR CONSTRUCTION	16,536 SF	$36.88	$609,850
6020 INTERIOR FINISHES	16,536 SF	$8.14	$134,598
SUBTOTAL INTERIORS	16,536 SF	$45.02	$744,448
B5 EQUIPMENT AND FURNISHINGS			
6030 EQUIPMENT	16,536 SF	$3.29	$54,477
SUBTOTAL EQUIPMENT AND FURNISHINGS	16,536 SF	$3.29	$54,477
B6 ELEVATOR			
7010 Elevators and Lifts	16,536 SF	$3.76	$62,214
SUBTOTAL ELEVATOR	16,536 SF	$3.76	$62,214
B7 PLUMBING, HVAC, ELECTRICAL			
8010 PLUMBING SYSTEMS	16,536 SF	$5.10	$84,334
8020 FIRE PROTECTION	16,536 SF	$3.97	$65,648
8030 HVAC SYSTEMS			$493,750
8040 ELECTRICAL	16,536 SF	$18.53	$306,400
8050 RENEWABLE ENERGY TECHNOLOGIES			$233,600
SUBTOTAL PLUMBING, HVAC, ELECTRICAL	16,536 SF	$71.59	$1,183,731
SUBTOTAL BUILDING	16,536 SF	$219.36	$3,627,281
SUBTOTAL	*16,536 SF*	*$292.27*	*$4,832,946*
Contractor's Gen Requirements	10.0%	$29.23	$483,295
Contractor's Overhead	5.0%	$16.07	$265,812
Contractor's Profit	7.0%	$23.63	$390,744
SUBTOTAL	*16,536 SF*	*$361.20*	*$5,972,796*
Design Contingency	17.0%	$61.40	$1,015,375
Sustainable Design Contingency	3.0%	$12.68	$209,645
Architect/ Eng & Sustainable Fees	10.5%	$45.70	$755,771
DWEJ - Detroit Sustainability Center	**16,536 SF**	**$480.99**	**$7,953,588**

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03 Dec 2010 | DWEJ - Detroit Sustainability Center | 4:27:18PM

Estimate Detail | DWEJ Detroit Sustainability Center - Estimate of Probable Costs

	Quantity		Unit Cost	Total Cost
2010.1864.00 DWEJ - Detroit Sustainability Center				
A GENERAL REQUIREMENTS				
SURVEY				
Conventional Surveying, topographical, maximum	1.00	ACR	$4,207.52	$4,208
SUBTOTAL SURVEY				**$4,208**
GEOTECHNICAL				
Subsurface investigation, boring and exploratory drilling, report and recommendations from PE	4.00	EA	$823.90	$3,296
SUBTOTAL GEOTECHNICAL				**$3,296**
SUBTOTAL GENERAL REQUIREMENTS				**$7,503**
B SITEWORK				
G10 SITE PREPARATION				
2010 SITE DEMOLITION				
Site demolition, remove bituminous pavement, 4" to 6" thick	364.00	SY	$8.60	$3,130
Site demolition, remove concrete curbs, plain	913.00	LF	$4.55	$4,150
Site demolition, remove existing catch basin or manhole, masonry	4.00	EA	$409.09	$1,636
Site demolition, concrete, plain, 4" thick, remove, excludes hauling	1,015.00	SY	$10.23	$10,381
Selective clearing, brush, medium clearing, with dozer,	0.50	ACR	$1,458.48	$729
SUBTOTAL SITE DEMOLITION				**$20,027**
2015 SITE ENVIRONMENTAL				
Phase II Sampling & Subsurface investigation, boring and exploratory drilling, report and recommendations for Contamination & corrective action	20.00	EA	$1,386.50	$27,730
Tank Removal (Allowance)	1.00	Allow	$10,000.00	$10,000
Contaminated Soil Remediation (Allowance - Difficult to predict extent of required clean-up)	1.00	Allow	$135,000.00	$135,000
SUBTOTAL SITE ENVIRONMENTAL				**$172,730**
SUBTOTAL SITE PREPARATION				**$192,757**
G20 SITE IMPROVEMENTS				
2020 ROADWAY EDGES				
20 Curbs & Gutters				
Concrete curb and gutter, straight, wood forms, 0.055 C.Y. per L.F., 6" high curb, 6" thick gutter, 24" wide, cast-in-place	913.00	LF	$25.92	$23,669
SUBTOTAL Curbs & Gutters				**$23,669**
SUBTOTAL ROADWAY EDGES				**$23,669**
2030 PEDESTRIAN PAVING				
Porus Pavers/ Pavement	40,600.00	LF	$10.75	$436,450
SUBTOTAL PEDESTRIAN PAVING				**$436,450**
2040 SITE DEVELOPMENT				
0 Flagpoles				
Specialties, flagpole, on grade, aluminum, tapered, 20' high	2.00	EA	$1,534.84	$3,070
SUBTOTAL Flagpoles				**$3,070**
15 Erosion Control				
Erosion control, silt fence, polypropylene, ideal conditions, 3' high	930.00	LF	$0.91	$844

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03 Dec 2010 | DWEJ - Detroit Sustainability Center | 4:27:18PM

Estimate Detail | DWEJ Detroit Sustainability Center - Estimate of Probable Costs

	Quantity		Unit Cost	Total Cost
SUBTOTAL Erosion Control				**$844**
Stormwater Planters				
Stormwater Planter structures	1.00	Allow	$45,000.00	$45,000
SUBTOTAL Stormwater Planters				**$45,000**
Water Feature				
Water/ Artwork Feature	1.00	Allow	$125,000.00	$125,000
SUBTOTAL Water Feature				**$125,000**
Water Storage Structure				
Cistern for water collection & storage	2.00	Allow	$4,000.00	$8,000
SUBTOTAL Water Storage Structure				**$8,000**
Greenhouse				
Greenhouse, enclosed, 12' x 16'	1.00	Allow	$32,000.00	$32,000
SUBTOTAL Greenhouse				**$32,000**
Site Amenities				
Trash receptacle, Stainless Steel, circular, 2' diameter, 2' - 6" high	2.00	EA	$1,879.00	$3,758
Bicycle Racks	5.00	EA	$325.00	$1,625
Park benches, aluminum pedestals, with backs, aluminum slats, 8' long	2.00	EA	$886.70	$1,773
SUBTOTAL Site Amenities				**$7,156**
Geothermal Ice-Melt system				
Geothermal Ice/snow melt system, includes piping, controls - tied into building Geothermal system	1.00	Allow	$115,000.00	$115,000
SUBTOTAL Geothermal Ice-Melt system				**$115,000**
SUBTOTAL SITE DEVELOPMENT				**$336,070**
2050 LANDSCAPING				
5 Native/ Adaptive Plants				
Drougt tolerant native/ adaptiv plants, planted in prepared beds	1.00	Allow	$72,000.00	$72,000
SUBTOTAL Native/ Adaptive Plants				**$72,000**
10 Water Cleansing Biotope				
Water Cleansing Biotope	1.00	Allow	$60,000.00	$60,000
SUBTOTAL Water Cleansing Biotope				**$60,000**
Expressway Edge Plantings				
Hillside Prairie plantings, includes soil prep	1.00	Allow	$14,000.00	$14,000
SUBTOTAL Expressway Edge Plantings				**$14,000**
SUBTOTAL LANDSCAPING				**$146,000**
SUBTOTAL SITE IMPROVEMENTS				**$942,190**
G30 SITE MECHANICAL UTILITIES				
3010 WATER SUPPLY				
Ductile iron pipe, cement lined, mechanical joint, no fittings, 18' lengths, 6" diameter, class 50	60.00	LF	$45.99	$2,760
Fitting, 90 degree bend or elbow, mechanical joint, ductile iron, cement lined, 6" diameter, class 50 water piping	3.00	EA	$617.72	$1,853
Butterfly valves, cast iron, with extension box, 6" diameter	2.00	EA	$2,011.91	$4,024

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03 Dec 2010 | **DWEJ - Detroit Sustainability Center** | **4:27:18PM**

Estimate Detail | **DWEJ Detroit Sustainability Center - Estimate of Probable Costs**

	Quantity		Unit Cost	Total Cost
Fire hydrants, two way, 7'-0" depth, 4-1/2" valve, includes mechanical joints	1.00	EA	$2,513.80	$2,514
SUBTOTAL WATER SUPPLY				**$11,150**
3020 SANITARY SEWER				
Excavating, trench or continuous footing, loam or sandy clay, 3/4 C.Y. excavator, 6' to 10' deep, excludes sheeting or dewatering	37.00	CY	$6.52	$241
Polyvinyl chloride pipe, B & S, 10' lengths, 6" diameter, SDR 35, excludes excavation or backfill	50.00	LF	$6.59	$329
Manholes, concrete, precast, 4' I.D., 8' deep, base, backfill, frame and cover	1.00	EA	$2,207.08	$2,207
SUBTOTAL SANITARY SEWER				**$2,778**
3030 STORM SEWER				
Excavating, trench or continuous footing, common earth, 3/4 C.Y. excavator, 6' to 10' deep, excludes sheeting or dewatering	69.00	CY	$7.05	$486
Reinforced concrete pipe (RCP), 12" diameter, 6' lengths, class 3, excludes excavation or backfill, gaskets	80.00	LF	$35.02	$2,802
Catch basins, frames and covers, cast iron, 26" D shape, 600 lb., excludes footing, excavation, and backfill	2.00	EA	$736.28	$1,473
Manholes, concrete, precast, 4' I.D., 6' deep, excludes base, excavation, backfill, frame and cover	3.00	EA	$1,668.45	$5,005
SUBTOTAL STORM SEWER				**$9,766**
SUBTOTAL SITE MECHANICAL UTILITIES				**$23,694**
G40 SITE ELECTRICAL UTILITIES				
4010 ELECTRICAL DISTRIBUTION				
Underground Service feed to building, includes feeders, excavation, backfill and cast in place concrete	1.00	Allow	$5,921.58	$5,922
SUBTOTAL ELECTRICAL DISTRIBUTION				**$5,922**
4020 SITE LIGHTING				
Site lighting, LED Fixture, with controls, aluminum pole, 16' high, includes excavation, base & power	7.00	EA	$4,800.00	$33,600
SUBTOTAL SITE LIGHTING				**$33,600**
SUBTOTAL SITE ELECTRICAL UTILITIES				**$39,522**
SUBTOTAL SITEWORK				**$1,198,162**
C BUILDING				
B1 DEMOLITION & REMEDIATION				
5010 Selective Building Demolition				
Roof demolition, remove concrete deck, to 3" thick, excludes hauling and disposal fees	14,082.00	SF	$1.74	$24,503
Partial Building demolition, small buildings or single buildings, concrete, includes 20 mile haul, excludes salvage, foundation demolition or dump fees	16,766.00	CF	$0.43	$7,147
Footings and foundations demolition, floors, concrete slab on grade, concrete, wire mesh reinforced, 4" thick, excludes disposal costs and dump fees	14,082.00	SF	$2.11	$29,713
Cutout demolition, toothing masonry cutouts, block, hard mortar, toothing	220.00	VLF	$8.01	$1,761
Dump charges, typical urban city, reclamation station, usual charge, includes tipping fees only	150.00	TON	$112.33	$16,849
Gutting, building interior, commercial building, includes disposal, excludes dumpster fees, minimum	3,664.00	SF	$2.96	$10,845
SUBTOTAL Selective Building Demolition				**$90,819**

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03 Dec 2010 | DWEJ - Detroit Sustainability Center | 4:27:18PM

Estimate Detail | DWEJ Detroit Sustainability Center - Estimate of Probable Costs

	Quantity		Unit Cost	Total Cost
5020 Environmental Remediation				
Remediation of Asbestos materials (Allowance)	16,600.00	SF	$0.92	$15,272
Removal Of Existing Lead Paint (Allowance)	16,600.00	SF	$1.39	$23,074
Demo in mold contam area, ceiling	2,570.00	SF	$2.34	$6,025
Hazardous waste clean-up & remediation (Allowance)	1.00	Allow	$50,000.00	$50,000
SUBTOTAL Environmental Remediation				**$94,371**
SUBTOTAL DEMOLITION & REMEDIATION				**$185,189**
B2 FOUNDATIONS & FLATWORK				
5030 FOUNDATIONS				
1010 Standard Foundations				
Strip footing, concrete, reinforced, load 10.0 KLF, soil bearing capacity 3 KSF, 16" wide x 48" deep	152.00	LF	$64.87	$9,861
Elevator pad, 3000 PSI concrete, load 150K, soil bearing capacity 3 KSF, 8' - 0" square x 16" deep	1.00	EA	$989.99	$990
Grade beam, 20' span, 40" deep, 12" wide, 8 KLF load	152.00	LF	$95.31	$14,487
SUBTOTAL Standard Foundations	**16,536**	**SF**	**$1.53**	**$25,338**
Greenhouse Foundations				
Strip footing, concrete, reinforced, load 10.1 KLF, soil bearing capacity 3 KSF, 12" deep x 48" wide	62.00	LF	$53.38	$3,310
SUBTOTAL Greenhouse Foundations				**$3,310**
SUBTOTAL FOUNDATIONS	**16,536**	**SF**	**$1.73**	**$28,647**
5040 FLATWORK				
Slab on Grade				
Perimeter Insulation, polystyrene, expanded, 2" thick, R8	1,260.00	SF	$1.49	$1,876
Slab on grade, 4" thick, non industrial, reinforced	2,861.00	SF	$4.94	$14,139
Slab on grade, 6" thick, light industrial, reinforced	12,610.00	SF	$7.51	$94,763
SUBTOTAL Slab on Grade				**$110,778**
Mezzanine Floor Slab				
Floor, metal deck, 18 ga, 3" deep concrete slab, 125 PSF superimposed load, 169 PSF total load	1,320.00	SF	$6.94	$9,165
SUBTOTAL Mezzanine Floor Slab				**$9,165**
SUBTOTAL FLATWORK				**$119,942**
SUBTOTAL FOUNDATIONS & FLATWORK	**16,536**	**SF**	**$8.99**	**$148,590**
B3 BUILDING SHELL				
5060 STRUCTURAL FRAMING				
Mezzanine Framing				
Column, structural tubing, 6" x 6" x 1/4" x 12'-0", incl shop primer, cap & base plate, bolts	8.00	EA	$465.98	$3,728
Structural steel member, W12x14, A992 steel, shop fabricated, incl shop primer, bolted connections	340.00	LF	$27.09	$9,210
Structural steel member, W14x34, A992 steel, shop fabricated, incl shop primer, bolted connections	132.00	LF	$56.13	$7,409
SUBTOTAL Mezzanine Framing				**$20,347**
1010 Flat Roof Framing				

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03 Dec 2010 **DWEJ - Detroit Sustainability Center** **4:27:18PM**

Estimate Detail **DWEJ Detroit Sustainability Center - Estimate of Probable Costs**

	Quantity		Unit Cost	Total Cost
Structural steel member, 100-ton project, 1 to 2 story building, W12x14, A992 steel, shop fabricated, incl shop primer, bolted connections	80.00	LF	$27.09	$2,167
Individual steel bearing plate, 6" x 6" x 1/4", with J-hook	10.00	EA	$11.00	$110
Metal decking, steel, open type, wide rib, galvanized, 50 to 500 Sq, 1-1/2" D, 22 ga	3,319.00	SF	$2.06	$6,836
SUBTOTAL Flat Roof Framing	**16,536**	**SF**	**$0.55**	**$9,113**
1020 Pitched Roof Framing				
Angle framing, structural steel, 3"x3"x3/8", field fabricated, incl cutting & welding	418.00	LF	$43.92	$18,360
Laminated Wood deck, 4" thick, Fir	9,850.00	SF	$14.19	$139,759
SUBTOTAL Pitched Roof Framing	**16,536**	**SF**	**$9.56**	**$158,120**
Cafe Roof Modifcations				
Column, structural, 12" dia x 18'-0" H, extra strong pipe, incl shop primer, cap & base plate, exlc bolts	6.00	EA	$1,674.87	$10,049
Angle framing, structural steel, 3"x3"x3/8", field fabricated, incl cutting & welding	118.00	LF	$43.92	$5,183
Structural steel member, W12x26, A992 steel, shop fabricated, incl shop primer, bolted connections	220.00	LF	$44.29	$9,744
Structural steel member, W16x40, A992 steel, shop fabricated, incl shop primer, bolted connections	60.00	LF	$65.10	$3,906
Metal decking, steel, open type, wide rib, galvanized, over 500 Sq, 1-1/2" D, 22 ga	1,612.00	SF	$1.93	$3,112
SUBTOTAL Cafe Roof Modifcations				**$31,994**
Canopy Framing				
Pipe Support 6" dia, extra strong pipe, incl shop primer, cap & base plate, bolts	760.00	LB	$1.87	$1,421
Angle framing, structural steel, 3"x3"x3/8", field fabricated, incl cutting & welding	132.00	LF	$43.92	$5,798
Angle framing, structural steel, 3"x3"x3/8", field fabricated, incl cutting & welding	24.00	LF	$43.92	$1,054
Channel framing, structural steel, field fabricated, C8x11.5, incl cutting & welding	80.00	LF	$69.64	$5,571
Channel framing, structural steel, field fabricated, C12 x 20.7, incl cutting & welding	518.00	LF	$84.79	$43,921
Tie rod, not upset, with turnbuckle, 1-1/2" to 4" dia, shop fabricated, incl shop primer, fasteners	50.00	LB	$3.36	$168
Steel plate, structural, for connections & stiffenners, 3/8" T, shop fabricated, incl shop primer	37.00	SF	$19.92	$737
Metal decking, steel, open type, wide rib, galvanized, over 500 Sq, 1-1/2" D, 22 ga	762.00	SF	$1.93	$1,471
Laminated Roof Deck, fir, 3" thick	528.00	SF	$6.46	$3,408
SUBTOTAL Canopy Framing				**$63,550**
Clearstory Framing				
Structural Steel Tube framing, 4" and 6" members	2,916.00	LB	$2.51	$7,322
Angle framing, structural steel, 3"x3"x3/8", field fabricated, incl cutting & welding	192.00	LF	$43.92	$8,433
Laminated Roof Deck, fir, 3" thick	1,536.00	SF	$6.46	$9,915
SUBTOTAL Clearstory Framing				**$25,671**
Wall Framing/ Lintels				
Structural steel member, 100-ton project, 1 to 2 story building, W8x15, A992 steel, shop fabricated, incl shop primer, bolted connections	91.00	LF	$31.79	$2,893

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Estimate Detail **DWEJ Detroit Sustainability Center - Estimate of Probable Costs**

	Quantity		Unit Cost	Total Cost
Structural steel member, 100-ton project, 1 to 2 story building, W12x26, A992 steel, shop fabricated, incl shop primer, bolted connections	528.00	LF	$44.29	$23,385
SUBTOTAL Wall Framing/ Lintels				**$26,279**
Stair Structures				
Stairs, steel, cement filled metal pan & picket rail, 8 risers, w/o landing	1.00	FLT	$7,737.85	$7,738
Stairs, steel, cement filled metal pan & picket rail, 20 risers, with landing	1.00	FLT	$15,547.49	$15,547
SUBTOTAL Stair Structures				**$23,285**
Green Roof Terrace Trellis				
Column, structural tubing, 6" x 6" x 1/4" x 12'-0", incl shop primer, cap & base plate, bolts	2.00	EA	$465.98	$932
Structural steel member, 100-ton project, 1 to 2 story building, W10x22, A992 steel, shop fabricated, incl shop primer, bolted connections	62.00	LF	$41.67	$2,583
SUBTOTAL Green Roof Terrace Trellis				**$3,515**
SUBTOTAL STRUCTURAL FRAMING	**16,536**	**SF**	**$21.88**	**$361,874**
5070 EXTERIOR ENCLOSURE				
2010 Exterior Walls				
Reclaimed brick, veneer, running bond, 6.75/S.F., 4" x 2-2/3" x 8", includes 3% brick and 25% mortar waste,	2,228.00	SF	$17.48	$38,945
Concrete masonry unit (CMU), back-up, normal weight, tooled joint one side, 2000 psi, 4" x 8" x 16", includes mortar, excludes scaffolding, horizontal reinforcing, vertical reinforcing and grout	952.00	SF	$6.72	$6,401
Concrete masonry unit (CMU), back-up, normal weight, tooled joint one side, 2000 psi, 8" x 8" x 16", includes mortar, excludes scaffolding, horizontal reinforcing, vertical reinforcing and grout	3,368.00	SF	$8.40	$28,278
GKD Stainless Steel Mesh	480.00	SF	$73.00	$35,040
6" x 8' High Stud Framing, galv LB studs, 16 ga, 16" O.C., incl galv top & bottom track, excl openings, headers, beams, bracing & bridging	115.00	LF	$35.12	$4,039
6" x 20' High Stud Framing, galv LB studs, 14 ga, 16" O.C., incl galv top & bottom track, excl openings, headers, beams, bracing & bridging	217.00	LF	$74.39	$16,143
1/2" exterior gypsum sheathing, weatherproof	2,135.00	SF	$1.64	$3,501
Extruded polystyrene insulation, rigid, for walls, 25 PSI compressive strength, 2" thick, R10	2,135.00	SF	$1.93	$4,117
Closed Cell foam insulation, 2" thick, R-13.4 sprayed	2,135.00	SF	$1.90	$4,057
Building Paper, vapor barrier, housewrap, exterior, spun bonded polypropylene, small roll	2,135.00	SF	$0.42	$892
Building Paper, polyethylene vapor barrier, standard, .004" thick, 9' x 400' roll	2,135.00	SQ	$17.40	$37,149
Cor-ten Steel Siding Panels, on steel framing, 24 gauge, incl. concelaed fasteners	1,449.00	SF	$17.83	$25,836
Trespa Wall Panels with aluminum framing system, incl. fasteners	2,173.00	SF	$37.00	$80,401
Gypsum wallboard, on walls, w/compound skim coat (level 5 finish), 5/8" thick	2,135.00	SF	$1.77	$3,769
SUBTOTAL Exterior Walls	**16,536**	**SF**	**$17.45**	**$288,565**
2020 Exterior Windows				
Operable Window, aluminum, awning type, insulated glass, thermal broken frame, incl. glass	291.00	SF	$68.87	$20,041
Curtain Wall, aluminum, stock, double glazed, incl. glazing, average	3,525.00	SF	$62.87	$221,617
Operable Glass Wall system	326.00	SF	$157.61	$51,381

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Estimate Detail | DWEJ Detroit Sustainability Center - Estimate of Probable Costs

	Quantity		Unit Cost	Total Cost
SUBTOTAL Exterior Windows	**16,536**	**SF**	**$17.72**	**$293,039**
2030 Exterior Doors				
Frames, steel, knock down, single, 16 ga., up to 5-3/4" deep, 7'-0" h x 3'-0" w	1.00	EA	$209.17	$209
Doors, commercial, steel, insulated, half glass, 18 ga., 3'-0" x 7'-0" x 1-3/4" thick	1.00	EA	$731.79	$732
Door, aluminum & glass, without transom, narrow stile, with panic hardware, 3'-0"x 7'-0"opening	1.00	OPN	$2,458.03	$2,458
Door, aluminum & glass, without transom, narrow stile, double door, hardware, 6'-0" x 7'-0" opening	4.00	OPN	$4,161.32	$16,645
Door, steel, overhead, rolling, electric operator, 12'-0" x 14'-0" opening	1.00	OPN	$6,367.83	$6,368
Door, steel, vertical lift, door with frame, motor operator, 16"-0" x 12"-0" opening	1.00	OPN	$19,826.25	$19,826
SUBTOTAL Exterior Doors	**16,536**	**SF**	**$2.80**	**$46,238**
Exterior Green Wall				
Column, structural tubing, 4" x 4" x 1/4" x 12'-0", incl shop primer, cap & base plate, bolts	7.00	EA	$322.09	$2,255
Greenscreen Wall	680.00	SF	$12.75	$8,670
Strip footing, concrete, unreinforced, load 3.9 KLF, soil bearing capacity 3 KSF, 8" deep x 24" wide	28.00	LF	$24.26	$679
SUBTOTAL Exterior Green Wall				**$11,604**
SUBTOTAL EXTERIOR ENCLOSURE	**16,536**	**SF**	**$38.67**	**$639,446**
5080 ROOFING				
3010 Roof Coverings				
Vegetated green roof system	14,422.00	SF	$9.82	$141,624
Roofing, single ply membrane, reinforced, TPO, 60 mils, fully adhered, adhesive	14,422.00	SF	$2.96	$42,689
Insulation, rigid, roof deck, polyisocyanurate, 2#/CF, 3.5" thick, R25	14,422.00	SF	$2.76	$39,874
Roof edges, aluminum, mill finish, .050" thick, 4" face	922.00	LF	$20.88	$19,254
SUBTOTAL Roof Coverings	**16,536**	**SF**	**$14.72**	**$243,441**
3020 Roof Openings				
Roof mounted light collector	5.00	EA	$773.87	$3,869
SUBTOTAL Roof Openings	**16,536**	**SF**	**$0.23**	**$3,869**
SUBTOTAL ROOFING	**16,536**	**SF**	**$14.96**	**$247,310**
SUBTOTAL BUILDING SHELL	**16,536**	**SF**	**$75.51**	**$1,248,631**
B4 INTERIORS				
6010 INTERIOR CONSTRUCTION				
1010 Partitions				
Reclaimed brick, veneer, running bond, 4" x 2-2/3" x 8", includes 3% brick and 25% mortar waste, excludes scaffolding, grout and reinforcing	2,534.00	SF	$13.60	$34,462
Decorative Wood panels, prefinished, stock grades, 3/4" thick, maximum	2,828.00	SF	$9.78	$27,658
Translucent Acrylic Panel, Class "A"	935.00	SF	$51.76	$48,396
Sound Attenuation Blankets, 3" thick	16,320.00	SF	$1.14	$18,605
Concrere block (CMU) partition, regular weight, hollow, 8" thick, no finish	1,330.00	SF	$9.08	$12,073
Metal partition, 5/8"fire rated gypsum board face, no base,3 -5/8" @ 24" OC framing, same opposite face, no insulation	16,320.00	SF	$3.84	$62,669

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Estimate Detail | **DWEJ Detroit Sustainability Center - Estimate of Probable Costs**

	Quantity		Unit Cost	Total Cost
SUBTOTAL Partitions	**16,536**	**SF**	**$12.33**	**$203,862**
1020 Interior Doors				
Door, aluminum & glass, without transom, narrow stile, double door, hardware, 6'-0" x 7'-0" opening	1.00	OPN	$4,161.32	$4,161
Operable wall partitions, with track, 3" thick, deluxe	372.00	SF	$105.51	$39,250
Metal door/metal frame, flush-hollow core, 20 ga full panel, 2'-8" x 6'-8", butt weld frame, 8-3/4"	23.00	EA	$949.45	$21,837
Wood door/metal frame, particle core/flush, birch face, 6'-0" x 7'-0", butt weld frame, 8-3/4"	23.00	EA	$897.68	$20,647
Hinges, full mortise, low frequency, steel base, 4-1/2" x 4-1/2", USP	69.00	EA	$6.97	$481
Locksets, heavy duty cylindrical, keyed, single cylinder function	23.00	EA	$152.14	$3,499
Closers, rack & pinion, adjustable backcheck, 3 way mount, non-sized, regular arm	18.00	EA	$245.27	$4,415
Panic devices, narrow stile, rim mounted, outside key & pull	10.00	EA	$819.88	$8,199
SUBTOTAL Interior Doors	**16,536**	**SF**	**$6.20**	**$102,489**
Interior Glazing				
Tube Framing, for window walls and storefronts, aluminum, stock, plain tube frame, mill finish, 1-3/4" x 4-1/2"	788.00	LF	$22.29	$17,565
Float Glass, clear, plain, 1/2" thick	1,656.00	SF	$37.29	$61,760
SUBTOTAL Interior Glazing				**$79,325**
1030 Washroom Accessories				
Mirrors, wall type, polished edge, 1/4" plate glass, over 5 SF, excl. frames	792.00	SF	$13.94	$11,037
Bathroom Accessories, grab bars, straight, stainless steel, 1 1/4" dia x 18" long	7.00	EA	$51.99	$364
Bathroom accessories, grab bar, straight, 1-1/4" dia, SS, 42" long	7.00	EA	$69.24	$485
Toilet partitions, cubicless, floor mounted, headrail braced, painted metal	4.00	LS	$684.31	$2,737
Urinal screens, floor mounted, 24" wide, painted metal	1.00	LS	$367.51	$368
Directory boards, building, aluminum, black felt panel, 24" x 18"	1.00	EA	$615.59	$616
Electric Hand Dryer	7.00	EA	$764.00	$5,348
Bathroom accessories, stainless steel, grab bar, 1-1/2" diameter, 36" long	7.00	LF	$63.33	$443
Bathroom accessories, stainless steel, toilet tissue dispenser, surface mounted, double roll	9.00	EA	$63.42	$571
SUBTOTAL Washroom Accessories	**16,536**	**SF**	**$1.33**	**$21,968**
Millwork				
Casework, base cabinets, wood, custom fabricated, 24" deep, 34" high	61.00	LF	$269.34	$16,430
Casework, wall units, 12" deep, 42" high	51.00	LF	$228.75	$11,666
Reception Counter, Resource Center Counter, Cafe Counter	66.00	LF	$545.40	$35,996
Worksurface counter tops, 24" wide, includes backsplash	124.00	LF	$75.75	$9,393
Solid Surface Countertops, acrylic polymer, solid colors, pricing for orders of 100 LF or more, 25" wide	73.00	LF	$126.60	$9,242
SUBTOTAL Millwork				**$82,727**
Ceilings				
Sound Attenuation Blankets, thermal or acoustical batt above ceiling, 3" thick	4,052.00	SF	$1.42	$5,754
Gypsum board ceilings, 5/8" fire rated gypsum board, painted and textured finish,1-5/8" metal stud furring, 24" OC suppo	4,052.00	SF	$3.40	$13,777
SUBTOTAL Ceilings				**$19,531**

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Estimate Detail | **DWEJ Detroit Sustainability Center - Estimate of Probable Costs**

	Quantity		Unit Cost	Total Cost
Living Green Wall				
Living "Green" Wall	600.00	SF	$166.58	$99,948
SUBTOTAL Living Green Wall				**$99,948**
SUBTOTAL INTERIOR CONSTRUCTION	**16,536**	**SF**	**$36.88**	**$609,850**
6020 INTERIOR FINISHES				
3010 Wall Finishes				
Surface Preparation, interior, walls, wash, masonry, brick & block, coarse	5,432.00	SF	$0.22	$1,184
Painting, interior on plaster and drywall, walls & ceilings, roller work, primer & 2 coats	31,738.00	SF	$0.77	$24,587
Painting, masonry or concrete, latex, brushwork, primer & 2 coats	5,432.00	SF	$1.63	$8,867
Paneling, prefinished plywood, birch	2,828.00	SF	$3.99	$11,281
Ceramic tile, thin set, 4-1/4" x 4-1/4"	272.00	SF	$7.02	$1,909
SUBTOTAL Wall Finishes	**16,536**	**SF**	**$2.89**	**$47,828**
3020 Floor Finishes				
Carpet tile, nylon, fusion bonded, 18" x 18" or 24" x 24", 35 oz	4,269.00	SF	$5.04	$21,535
Concrete polishing	11,667.00	SF	$4.54	$52,968
Ceramic or Porcelian Tile - Mid Grade	866.00	SF	$9.41	$8,149
SUBTOTAL Floor Finishes	**16,536**	**SF**	**$5.00**	**$82,653**
3030 Ceiling Finishes				
Paints & Coatings, ceilings, interior, drywall or plaster, 2 coats, smooth finish, spray	4,052.00	SF	$0.67	$2,715
Dry fall painting, ceilings, structural steel, bar joists or metal deck, one coat, spray	2,985.00	SF	$0.47	$1,403
SUBTOTAL Ceiling Finishes	**16,536**	**SF**	**$0.25**	**$4,118**
SUBTOTAL INTERIOR FINISHES	**16,536**	**SF**	**$8.14**	**$134,598**
SUBTOTAL INTERIORS	**16,536**	**SF**	**$45.02**	**$744,448**
B5 EQUIPMENT AND FURNISHINGS				
6030 EQUIPMENT				
1010 Cafe Equipment				
Freezers, commercial kitchen equipment, reach-in, 2 compartment	1.00	EA	$4,825.94	$4,826
Refrigerators, commercial kitchen equipment, with glass doors, 68 C.F.	2.00	EA	$7,484.36	$14,969
Shelving, commercial kitchen equipment, stainless steel, flat, 4-tier, 24" x 6'	4.00	EA	$2,491.31	$9,965
Coffee brewers, commercial kitchen equipment, 5 burner	1.00	EA	$1,501.98	$1,502
Bake oven, commercial kitchen equipment, gas, one section	1.00	EA	$5,072.36	$5,072
Cup & glass dispenser, commercial kitchen equipment, drop in	1.00	EA	$1,460.88	$1,461
Food warmer, commercial kitchen equipment, counter, 1.6KW	1.00	EA	$1,921.37	$1,921
Ice cube maker, commercial kitchen equipment, 250 lbs per day	1.00	EA	$3,389.13	$3,389
Casework, kitchen base cabinets, metal, maximum	28.00	LF	$225.25	$6,307
Counter Tops, stainless steel	28.00	SF	$180.87	$5,064
SUBTOTAL Cafe Equipment	**16,536**	**SF**	**$3.29**	**$54,477**
SUBTOTAL EQUIPMENT	**16,536**	**SF**	**$3.29**	**$54,477**
SUBTOTAL EQUIPMENT AND FURNISHINGS	**16,536**	**SF**	**$3.29**	**$54,477**
B6 ELEVATOR				

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Estimate Detail | DWEJ Detroit Sustainability Center - Estimate of Probable Costs

	Quantity		Unit Cost	Total Cost
7010 Elevators and Lifts				
Hydraulic, passenger elevator, 2500 lb, 2 floors, 100 FPM	1.00	EA	$62,214.39	$62,214
SUBTOTAL Elevators and Lifts	**16,536**	**SF**	**$3.76**	**$62,214**
SUBTOTAL ELEVATOR	**16,536**	**SF**	**$3.76**	**$62,214**
B7 PLUMBING, HVAC, ELECTRICAL				
8010 PLUMBING SYSTEMS				
2010 General Plumbing System				
Plumbing systems: fixtures, domestic water piping, electric hybrid heat pump water heater, sanitary piping, insulation, roof drains	16,536.00	SF	$3.96	$65,483
SUBTOTAL General Plumbing System	**16,536**	**SF**	**$3.96**	**$65,483**
2020 Grey Water System				
Grey Water System, filtration system and related piping	16,536.00	SF	$0.38	$6,284
SUBTOTAL Grey Water System	**16,536**	**SF**	**$0.38**	**$6,284**
2030 Solar Water Heating System				
Electrical Service to Building, lighting, lighting controls, power, fire alarm, security conduit & boxes	16,536.00	SF	$0.76	$12,567
SUBTOTAL Solar Water Heating System	**16,536**	**SF**	**$0.76**	**$12,567**
SUBTOTAL PLUMBING SYSTEMS	**16,536**	**SF**	**$5.10**	**$84,334**
8020 FIRE PROTECTION				
4010 Sprinklers				
Wet pipe sprinkler system, steel, ordinary hazard, 2 floors, less than 50,000 SF	16,536.00	SF	$3.97	$65,648
SUBTOTAL Sprinklers	**16,536**	**SF**	**$3.97**	**$65,648**
SUBTOTAL FIRE PROTECTION	**16,536**	**SF**	**$3.97**	**$65,648**
8030 HVAC SYSTEMS				
HVAC System				
HVAC System: Geothermal wells, geothermal heat exchanger, geothermal well pumps, VRF system, expansion tank, hydronic pumps, hydronic zone valves, BMS controls, fin-tube, boilers, ducts, DOAS system (with exhaust fan, supply fan and total energy wheel)	1.00	Allow	$485,000.00	$485,000
SUBTOTAL HVAC System				**$485,000**
Demonstrative Solar Thermal System				
Demonstrative Solar Thermal system, inclusive of all related piping and controls	1.00	Allow	$8,750.00	$8,750
SUBTOTAL Demonstrative Solar Thermal System				**$8,750**
SUBTOTAL HVAC SYSTEMS				**$493,750**
8040 ELECTRICAL				
5010 Electrical Service/Distribution				
Electrical Service to Building, lighting, lighting controls, power, fire alarm, security conduit & boxes	16,536.00	SF	$15.25	$252,174
SUBTOTAL Electrical Service/Distribution	**16,536**	**SF**	**$15.25**	**$252,174**
5030 Commnunications & Security				

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03 Dec 2010 | **DWEJ - Detroit Sustainability Center** | **4:27:18PM**

Estimate Detail | **DWEJ Detroit Sustainability Center - Estimate of Probable Costs**

	Quantity		Unit Cost	Total Cost
Detection Systems, burglar alarm, battery operated, electrical trigger, excl. wires & conduit	1.00	EA	$506.49	$506
Detection Systems, card reader, flush type, standard, excl. wires & conduit	2.00	EA	$1,221.12	$2,442
Detection Systems, door switches, magnetic switch, excl. wires & conduit	7.00	EA	$184.58	$1,292
Detection Systems, exit control locks, flashing light alarm, excl. wires & conduit	7.00	EA	$565.61	$3,959
Detection Systems, indicating panels, 20 channel, excl. wires & conduit	1.00	EA	$3,243.81	$3,244
Internet wiring, 8 data/voice outlets per 1000 S.F.	16.53	MSF	$2,588.15	$42,782
SUBTOTAL Commnunications & Security	**16,536**	**SF**	**$3.28**	**$54,226**
SUBTOTAL ELECTRICAL	**16,536**	**SF**	**$18.53**	**$306,400**
8050 RENEWABLE ENERGY TECHNOLOGIES				
Photovoltaic System				
20 KW Photovoltaic power system, stand alone, AC and DC loads	20,000.00	Watt	$10.00	$200,000
SUBTOTAL Photovoltaic System				**$200,000**
Wind Turbine				
Wind Turbine, 1.2 KW system	1,200.00	Allow	$28.00	$33,600
SUBTOTAL Wind Turbine				**$33,600**
SUBTOTAL RENEWABLE ENERGY TECHNOLOGIES				**$233,600**
SUBTOTAL PLUMBING, HVAC, ELECTRICAL	**16,536**	**SF**	**$71.59**	**$1,183,731**
SUBTOTAL BUILDING	**16,536**	**SF**	**$219.36**	**$3,627,281**
SUBTOTAL	***16,536***	***SF***	***$292.27***	***$4,832,946***
Contractor's Gen Requirements	10.0%		$29.23	$483,295
Contractor's Overhead	5.0%		$16.07	$265,812
Contractor's Profit	7.0%		$23.63	$390,744
SUBTOTAL	***16,536***	***SF***	***$361.20***	***$5,972,796***
Design Contingency	17.0%		$61.40	$1,015,375
Sustainable Design Contingency	3.0%		$12.68	$209,645
Architect/ Eng & Sustainable Fees	10.5%		$45.70	$755,771
DWEJ - Detroit Sustainability Center	**16,536**	**SF**	**$480.99**	**$7,953,588**

Appendix 12
Building Code Review

Detroit Sustainability Center
BUILDING CODE SUMMARY
inFORM studio
URS Corporation
City of Detroit
August 25th, 2010

Name of Project:	Detroit Sustainability Center (DSC)		
Address:	10123 Grand River Ave. East		
Owner or Authorized Agent:	Detroiters Working for Environmental Justice (DWEJ)		
Phone:	313.833.3935		
Fax:	313.833.3955		
Email:	sandrayu@dwej.org		
Owned By:	☒ Privately	☐ City/County	☐ State
Code Enforcement Jurisdiction:	☒ City	☐ County	☐ City/County
Name of Jurisdiction:	City of Detroit		

PROJECT SUMMARY:

Building Description:
The existing building is a one-story brick-clad, steel frame structure consisting of 3 distinct areas with a partial second floor area located at the north section of the building.

Scope of Work:
The project includes a complete renovation and retrofit of the existing structure to house the future Detroit Sustainability Center; which will include a Green Jobs Training Center, a Sustainable Solutions Lab, a Green Café, a Community Event/Exhibit space and Executive and Administrative Offices.

Lead Design Professional/Project Coordinator: inFORM studio / Cory Lavigne, AIA

DESIGNER	FIRM	NAME	LICENSE	TELEPHONE
Architectural:	inFORM studio	Ken Van Tine		248.449.3564
Civil:	URS Corporation	John Hollo		248.204.5900
Electrical:	URS Corporation	John Calice,		248.204.5900
Fire Alarm:	TBD			
Plumbing:	URS Corporation	Shariq Ali		248.204.5900
Mechanical:	URS Corporation	Shariq Ali		248.204.5900
Sprinkler-Standpipe:	TBD			
Structural:	URS Corporation	Abdul Brinjikji		248.204.5900
Landscape:	Conservation Design Forum	Patrick Judd		734.663.3751

CODE INFORMATION

Building Code:
- ☒ 2006 Michigan Building Code
- ☒ 2006 Michigan Rehabilitation Code for Existing Buildings
- ☒ 2003 Michigan Uniform Energy Code
- ☒ 2006 Michigan Plumbing Code
- ☒ 2006 Michigan Mechanical Code ☒ 2006 Michigan Electrical Code

New Building: ☐ New Building ☐ Shell Building ☐ First Time Interior Completion
☐ Addition ☐ Alteration to Shell

Existing Building: ☒ Renovation ☒ Interior Completion ☐ Tenant Alteration
☒ Reconstruction ☒ Repair ☒ Alteration to Shell
☒ Change of Use Tenant Space ☒ Change of Occupancy

Note: Zoning Review May Be Required for Change of Use or Occupancy

Original Occupancy: S1 (Motor Vehicle Repair Garage)

Proposed Occupancy: A2 (Café), A3 (Exhibit Gallery), B (Office, Research, Classroom), F1 (Training)

OCCUPANCY INFORMATION

Primary Occupancies: Assembly: ☐ A-1 ☒ A-2 ☒ A-3 ☐ A -4 ☐ A-5
☒ Business ☐ Educational Factory-Industrial: ☒ F-1 ☐ F-2
High-Hazard: ☐ H-1 ☐ H-2 ☐ H-3 ☐ H-4 ☐ H-5
Institutional: ☐ I-1 ☐ I-2 ☐ I-3 ☐ I-4
I-3 USE CONDITION: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
☐ Mercantile Residential: ☐ R-1 ☐ R-2 ☐ R-3 ☐ R-4
Storage: ☐ S-1 ☐ S-2 ☐ High-piled
S-1 SPECIAL CONDITION: ☐ Repair Garage (406.6)
S-2 SPECIAL CONDITION -- Parking Garage: ☐ Open (406.3) ☐ Enclosed (406.4)
☐ Utility and Miscellaneous

Other Uses:
Accessory Uses (Indicate Percentages): N/A
Incidental Uses: N/A

Special Occupancies: ☐ 402 ☐ 403 ☐ 404 ☐ 405 ☐ 406 ☐ 407 ☐ 408
☐ 409 ☐ 410 ☐ 411 ☐ 412 ☐ 413 ☐ 414 ☐ 415
☐ 416 ☐ 417 ☐ 418 ☐ 419 ☐ 420 ☐ 421

Mixed Occupancy: ☐ No ☒ Yes Separation: N/A
Exception: N/A

☒ Non-Separated Mixed Occupancy (508.3.2)

☐ Separated Mixed Occupancy (508.3.3)

$$\frac{\text{Actual Area of Occupancy A}}{\text{Allowable Area of Occupancy A}} + \frac{\text{Actual Area of Occupancy B}}{\text{Allowable Area of Occupancy B}} \leq 1$$

ALLOWABLE AREA AND HEIGHT CALCULATIONS

THIS SECTION FOR NEW, ADDITION, CHANGE OF USE, AND INTERIOR COMPLETIONS

Allowable Height and Building Area – Table 503

Group A-3	Type 2B Construction	55 feet (height) 2 Story 9,500 sq.ft.
Sprinkler Increase	Type 2B Construction	+20 feet (height) +1 Story +200% (buildings with more than 1 story above grade)

Frontage Increase (I_f)

$I_f = [F / P – 0.25]W / 30$
F= 542' (Building perimeter fronting on a public way or open space)
P= 601' (Perimeter or entire building)
W= 30'

$I_f = [542 / 601 – 0.25]30 / 30$
$I_f = 0.65$

Total Area Modifications (A_a)

$A_a = \{ A_t + [A_t \times I_f] + [A_t \times I_s] \}$
A_t= 9,500 (Area per story in accordance with Table 503)
I_f= 65% (area increase factor due to frontage)
I_s= 200% (area increase factor due to sprinkler)

$A_a = \{ 9500 + [9500 \times 1.65] + [9500 \times 2.0] \}$
A_a = 43,700 sq.ft. maximum area

BOTH BUILDING AND TENANT MUST BE INDICATED ON CHART BELOW

STORY NO.	OCCUPANCY	(A) BLDG AREA PER STORY (ACTUAL)	(B) TABLE 503 AREA	(C) % OPEN SPACE INCREASE I_f	(D) % SPRINKLER INCREASE I_s	(E) ALLOWABLE FLOOR AREA OR UNLIMITED	RATIO OF ACTUAL /ALLOWABLE	(F) MAXIMUM BUILDING AREA	SEPARATION RATING REQUIRED
1	A2,A3,B,F1	14,453	9,500	65%	200%	43,700	0.33		N/A
2	B	1,200	9,500	65%	200%	43,700	0.02		
								131,100	

ALLOWABLE HEIGHT

MOST RESTRICTIVE USE (A3)	ALLOWABLE HEIGHT (TABLE 503)	INCREASE FOR SPRINKLERS	SHOWN ON PLANS	CODE REFERENCE
Type of Construction	Type 2B		Type 2B	Table 601
Building Height in Feet	H = 55 ft	H + 20 ft = 75 ft	H = 28 ft	Table 503
Building Height in Stories	S = 2	S + 1 = 3	S = 2	Table 503

BUILDING DATA

Construction Type: ☐ I-A ☐ I-B ☐ II-A ☒ II-B ☐ III-A ☐ III-B
☐ IV-HT ☐ V-A ☐ V-B
Mixed construction: ☐ No ☒ Yes Types A2, A3, B, F1
Sprinklers: ☐ No ☒ Yes ☐ NFPA 13 ☐ NFPA 13R
☐ Partially Sprinklered ☐ Special Suppression
Standpipes: ☐ No ☒ Yes Class: ☐ I ☐ II ☐ III ☐ Wet ☒ Dry
Fire District: ☒ No ☐ Yes (Appendix D) ☐ Flood Hazard
Building Height: 28 Feet 2 Story
Basement: ☐ No ☒ Yes
Mezzanine: ☒ No ☐ Yes
High Rise: ☒ No ☐ Yes Life Safety Plan Sheet # (if provided): _____

Gross Building Area:

FLOOR	EXISTING (SQ FT)	NEW (SQ FT)	SUB-TOTAL
Basement			
Ground Floor	14,453	0	14,453
2nd Floor	1,200	0	1,200
TOTAL	15,653	0	**15,653**

Area of Project Tenant/Alteration/Renovation: 15,653 sq.ft.
Area of Construction: 15,653 sq.ft.

FIRE PROTECTION REQUIREMENTS

Life Safety Plan Sheet #, if Provided _____

BUILDING ELEMENT	FIRE SEPARATION DISTANCE (FEET)	RATING		DETAIL # AND SHEET #	DESIGN # FOR RATED ASSEMBLY	DESIGN # FOR RATED PENETRATION	DESIGN # FOR RATED JOINTS
		REQ'D*	PROVIDED (W/____ HR* REDUCTION)				
Bearing walls Exterior							
North	n/a						
East	n/a						
West	n/a						
South	n/a						
Interior Bearing Walls		n/a					
Nonbearing walls Exterior							
North	45 ft	0					
East	0 ft	0					
West	24 ft	0					
South	27 ft	0					
Interior Non Bearing Walls		0					
Structural frame, including columns, girders, trusses		0					
Floor construction, including supporting beams and joists. List construction type.		0					
Floor Ceiling Assembly		0					
Columns Supporting Floors		0					
Roof construction, including supporting beams and joists **		0					
Roof Ceiling Assembly		0					
Columns Supporting Roof		0					
Shafts – Exit Enclosures		1 hour					
Shafts – Other (describe)							
Shafts – Other (describe)							
Corridor Separation		0					
Occupancy Separation		0					
Party/Fire Wall Separation		n/a					
Incidental Use Separation		n/a					
Dwelling/Sleeping unit Separation		n/a					
Smoke Barrier Separation Tenant Separation		n/a n/a					

PERCENTAGE OF WALL OPENING CALCULATIONS

THIS SECTION REQUIRED FOR ALL PROJECTS

Allowable openings per Table 704.8

North Elevation	Fire Separation	45 feet
	Allowable Unprotected Openings	Unlimited
East Elevation	Fire Separation	0 feet
	Allowable Unprotected Openings	Not Permitted
South Elevation	Fire Separation	27 feet
	Allowable Unprotected Openings	70%
East Elevation	Fire Separation	24 feet
	Allowable Unprotected Openings	45%

WALL LEGENDS

THIS SECTION REQUIRED FOR ALL PROJECTS

CHECK IF THE FOLLOWING ARE PRESENT AND INDICATE BY A **WALL LEGEND** ON ALL PLANS

☐ Fire Partitions 708 ☐ Fire Walls 705 ☐ Fire Barriers 706 ☐ Smoke Partitions 710
☐ Smoke Barriers 709 ☐ Shaft Enclosure 707

LIFE SAFETY SYSTEM REQUIREMENTS

THIS SECTION REQUIRED FOR ALL PROJECTS

Emergency Lighting:	☐ No	☒ Yes
Exit Signs:	☐ No	☒ Yes
Fire Alarm:	☐ No	☒ Yes
Smoke Detection Systems:	☐ No	☒ Yes
Panic Hardware:	☐ No	☒ Yes

EXIT REQUIREMENTS
NUMBER AND ARRANGEMENT OF EXITS

THIS SECTION REQUIRED FOR ALL PROJECTS

FLOOR, ROOM AND/OR SPACE DESIGNATION	MINIMUM[2] NUMBER OF EXITS		TRAVEL DISTANCE		ARRANGEMENT MEANS OF EGRESS[1,3] (SECTION 1015.2)	
	REQUIRED	SHOWN ON PLANS	ALLOWABLE TRAVEL DISTANCE (TABLE 1016.1)	ACTUAL TRAVEL DISTANCE SHOWN ON PLANS	REQUIRED DISTANCE BETWEEN EXIT DOORS	ACTUAL DISTANCE SHOWN ON PLANS

[1] Corridor dead ends (Section 1017.3)
[2] Single exits (Section 1015.1; Section 1019.2)
[3] Common Path of Egress Travel (Section 1014.3)

OCCUPANT LOAD AND EXIT WIDTH

THIS SECTION REQUIRED FOR ALL PROJECTS

USE GROUP AND/OR SPACE DESIGNATION	(a)	(b)	(a/b)	(c)		EXIT WIDTH (in)[2,3,4,5]			
	AREA[1] SQ. FT.	AREA[1] PER OCCU-PANT	NUMBER OF OCCU-PANTS	EGRESS WIDTH PER OCCUPANT (TABLE 1005.1)		REQUIRED WIDTH (SECTION 1005.1) (a/b) x c		ACTUAL WIDTH SHOWN ON PLANS	
				STAIR	LEVEL	STAIR	LEVEL	STAIR	LEVEL
Executive Offices	2,125	100	22	0.20	0.15	4.4	3.3		
Admin. Offices	550	100	6	0.20	0.15	1.2	0.9		
I.T. Offices	98	100	1	0.20	0.15	.2	0.15		
YOPAP Offices	150	100	2	0.20	0.15	0.4	0.3		
YOPAP Classroom	573	20	28	0.20	0.15	5.6	4.2		
Green Jobs Classroom	810	20	40	0.20	0.15	8	6		
Green Jobs Workshop	2,600	50	52	0.20	0.15	10.4	7.8		
Green Jobs Lab	500	50	10	0.20	0.15	2	1.5		
Green Jobs Storage	250	300	1	0.20	0.15	0.2	0.15		
BUD Offices	307	100	3	0.20	0.15	0.6	0.45		
Exhibit / Event Space	2,466	15	164	0.20	0.15	32.8	24.6		
Resource Library	194	50	3	0.20	0.15	0.6	0.45		
Tech. Booth	56	100	1	0.20	0.15	0.2	0.15		
Cafe	722	15	48	0.20	0.15	9.6	7.2		
Kitchenette	207	200	2	0.20	0.15	0.4	0.3		
Total # of Occupants			383			76.6	57.45		

[1] See Table 1004.1.1 to determine whether net or gross area is applicable.
[2] Minimum stairway width (Section 1009.1); min. corridor width (Section 1017.2); min. door width (Section 1008.1.1)
[3] Minimum width of exit passageway (Section 1021.2)
[4] The loss of 1 means of egress shall not reduce the available capacity to less than 50 percent of the total required (Section 1005.1)
[5] Assembly occupancies (Section 1025)

ASSEMBLY OCCUPANCY INFORMATION

THIS SECTION FOR ASSEMBLY USE AREA(S)

Space Description	Area - SF	Occupant Load Factor	Occupant Load	Exit Width	Exit Quantity
Café	722 SF	15 Net	48	7.2”	1
Exhibit / Event	2,466 SF	15 Net	164	24.6”	2

TOTAL_____

PLUMBING FIXTURE REQUIREMENTS

THIS SECTION REQUIRED FOR ALL PROJECTS

OCCUPANCY	WATERCLOSETS		URINALS	LAVATORIES		SHOWERS/ TUBS	DRINKING FOUNTAINS	
	MALE	FEMALE		MALE	FEMALE		REGULAR	ACCESSIBLE
A2	1	1	n/a	1	1	n/a	n/a	n/a
A3	2	4	n/a	2	2	n/a	1	
B	2	3	1	3	3	n/a	2	
F1	1	1	n/a	1	1	n/a	1	
Total Required	6	9	1	7	7	0	4	
Total Provided	6	9	1	7	7	2	4	

BUILDING DRAIN SIZE	NUMBER OF BUILDING DRAINS	TOTAL FIXTURE UNIT LOAD	WATER SERVICE SIZE	NUMBER OF WATER SERVICES	TOTAL FIXTURE UNIT LOAD	NOTES	

Structural Design Loads

	Structure Conforms to "Conventional Light Frame Provisions of 2308		
1	__Yes, continue __No, Go to Line 9		
2	Roof Live Load =		PSF
3	Floor Live Load =		PSF
4	Ground Snow Load (Pg) =		PSF
5	Basic Wind Speed, 3 sec. Gust =		MPH
6	Seismic Site Class =		
7	Seismic Design Category =		
8	Go to Line 44		
9	**Live Loads**		Area
10	Floor Live Load (indicate area) =		PSF
11	Floor Live Load (indicate area) =		PSF
12	Floor Live Load (indicate area) =		PSF
13	Live Load Reduction used in Design	Yes	No
14	Roof Live Load =		PSF
15	**Roof Snow Load Data**		
16	Flat-Roof Snow Load (Pf) =		PSF
17	Snow Exposure Factor (Ce) =		
18	Snow Importance Factor (Is) =		
19	Thermal Factor (Ct) =		
20	**Wind Design Data**		
21	Basic Wind Speed, 3 sec. Gust =		MPH
22	Wind Importance Factor (Iw) =		
23	Wind Exposure		(If multiple exposures are used indicate directions)
24	Internal Pressure Coefficient		
25	Components and Cladding Loads =		(If elements are not designed by the registered design professional)
26	Wind Base Shear, Wx		KIPS
27	Wind Base Shear, Wyx		KIPS

28	Earthquake Design Data		
29	Seismic Important Factor (Ie) =		
30	Occupancy Category		
31	Mapped Spectral Response Acceleration Ss		
32	Mapped Spectral Response Acceleration S1		
33	Site Class		(Provide soils report if Site Class is not "D")
34	Spectral Response Coefficient, Sds =		
35	Spectral Response Coefficient, Sd1 =		
36	Seismic Design Category =		
37	Building (Structural) System		
38	Basic Seismic Force Resisting System		
39	Seismic Response Coefficient (Cs) =		
40	Response Modification Factor, R =		
41	Analysis Procedure Used =		
42	Seismic Base Shear, Sx		KIPS
43	Seismic Base Shear, Sy		KIPS
44	Soil Data		
45	Presumptive Soil Bearing Pressure =		PSF
46	Bearing Pressure per Soils Report		PSF
47	Deep Foundation Type		
48	Deep Foundation Allowable Loads		TONS, downward
49	Uplift		KIPS
50	Lateral		KIPS

ACCESSIBLE PARKING

OCCUPANCY TYPE	TOTAL # OF PARKING SPACES		# OF ACCESSIBLE SPACES PROVIDED		TOTAL # ACCESSIBLE PROVIDED
	REQUIRED	PROVIDED	REGULAR WITH 5' ACCESS AISLE	VAN SPACES WITH 8' ACCESS AISLE	
Exhibit/Event Space	35 spaces	35 spaces			
Cafe	8 spaces	8 spaces			
Green Jobs Dept.	25 spaces	25 spaces			
YOPAP Dept.	16 spaces	16 spaces			
Admin/Executive	8 spaces	8 spaces			
TOTAL	92 spaces	92 spaces			

SPECIAL APPROVALS

(Describe special approvals from local jurisdictions, County or State Department of Health, Michigan Department of Insurance, International Code Council, etc.)

ENERGY SUMMARY
THIS SECTION FOR NEW, ADDITIONS CHANGE OF USE, AND INTERIOR COMPLETION

ENERGY REQUIREMENTS:
The following data shall be considered minimum and any special attribute required to meet the energy code shall also be provided. Each Designer shall furnish the required portions of the project information for the plan data sheet. If energy cost budget method, state the annual energy cost budget vs. allowable annual energy cost budget.

THERMAL ENVELOPE

Method of Compliance:
☐ Prescriptive ☒ Performance ☐ Energy Cost Budget

Roof/ceiling Assembly (each assembly)
Description of assembly Pitched roof. Insulated. _____
_____
U-Value of total assembly R-30_____
R-Value of insulation_____
Skylights in each assembly N/A
U-Value of skylight ___N/A____
Total square footage of skylights in each assembly __N/A_____

Exterior Walls (each assembly)
Description of assembly __Curtain wall, CMU wall, Metal Panel
_____
U-Value of total assembly _R-30_____
R-Value of insulation _____
Openings (windows or doors with glazing)
U-Value of assembly 0.45_____
Shading coefficient _0.36_____
Projection factor _____
Low-e required, if applicable _____
Door R-Values_R-1.25_____

Walls adjacent to unconditioned space (each assembly)
Description of assembly _N/A_____
_____
U-Value of total assembly ____ N/A _____
R-Value of insulation _____ N/A _____
Openings (windows or doors with glazing)
U-Value of assembly N/A _____
Low-e required, if applicable__ N/A _____
Door R-Values_____ N/A _____

Walls below grade (each assembly)
Description of assembly ___ N/A _____
_____
U-Value of total assembly ___ N/A _____
R-Value of insulation _ N/A _____

Floors over unconditioned space (each assembly)

Description of assembly __ N/A _____

_____

U-Value of total assembly __ N/A _____

R-Value of insulation _ N/A _____

Floors slab on grade (each assembly)

Description of assembly _____

_____

U-Value of total assembly 0.73_____

R-Value of insulation _____

Horizontal/Vertical requirement _____

Slab heated _____

ELECTRICAL SUMMARY
ELECTRICAL SYSTEM AND EQUIPMENT
THIS SECTION REQUIRED FOR ALL PROJECTS THAT INCLUDE ELECTRICAL DESIGN

Method of Compliance:

☐ Prescriptive ☐ Performance ☐ Energy Cost Budget

Lighting Schedule

Lamp type required in fixture _____
Number of lamps in fixture _____
Ballast type used in the fixture _____
Number of ballasts in fixture _____
Total wattage per fixture _____
Total interior wattage specified vs. allowed _____
Total exterior wattage specified vs. allowed _____

Equipment schedules with motors (not used for mechanical systems)

Motor horsepower _____
Number of phases _____
Minimum efficiency _____
Motor type _____
No. of poles _____

MECHANICAL SUMMARY
MECHANICAL SYSTEMS, SERVICE SYSTEMS AND EQUIPMENT
THIS SECTION REQUIRED FOR ALL PROJECTS THAT INCLUDE MECHANICAL DESIGN

Method of Compliance:

☐ Prescriptive ☐ Performance ☐ Energy Cost Budget

Thermal zone

Winter dry bulb _____

Summer dry bulb _____

Interior design conditions

Winter dry bulb _____

Summer dry bulb _____

Relative humidity _____

Building heating load
Building cooling load
Mechanical Spacing Conditioning System

Unitary _____

Description of unit _____

Heating efficiency _____

Cooling efficiency _____

Heat output of unit _____

Cooling output of unit _____

Boiler _____

Total boiler output. If oversized, state reason _____

Chiller _____

Total chiller capacity. If oversized, state reason _____

List equipment efficiencies
Equipment schedules with motors (mechanical systems)

Motor horsepower _____

Number of phases _____

Minimum efficiency _____

Motor type _____

# of poles _____