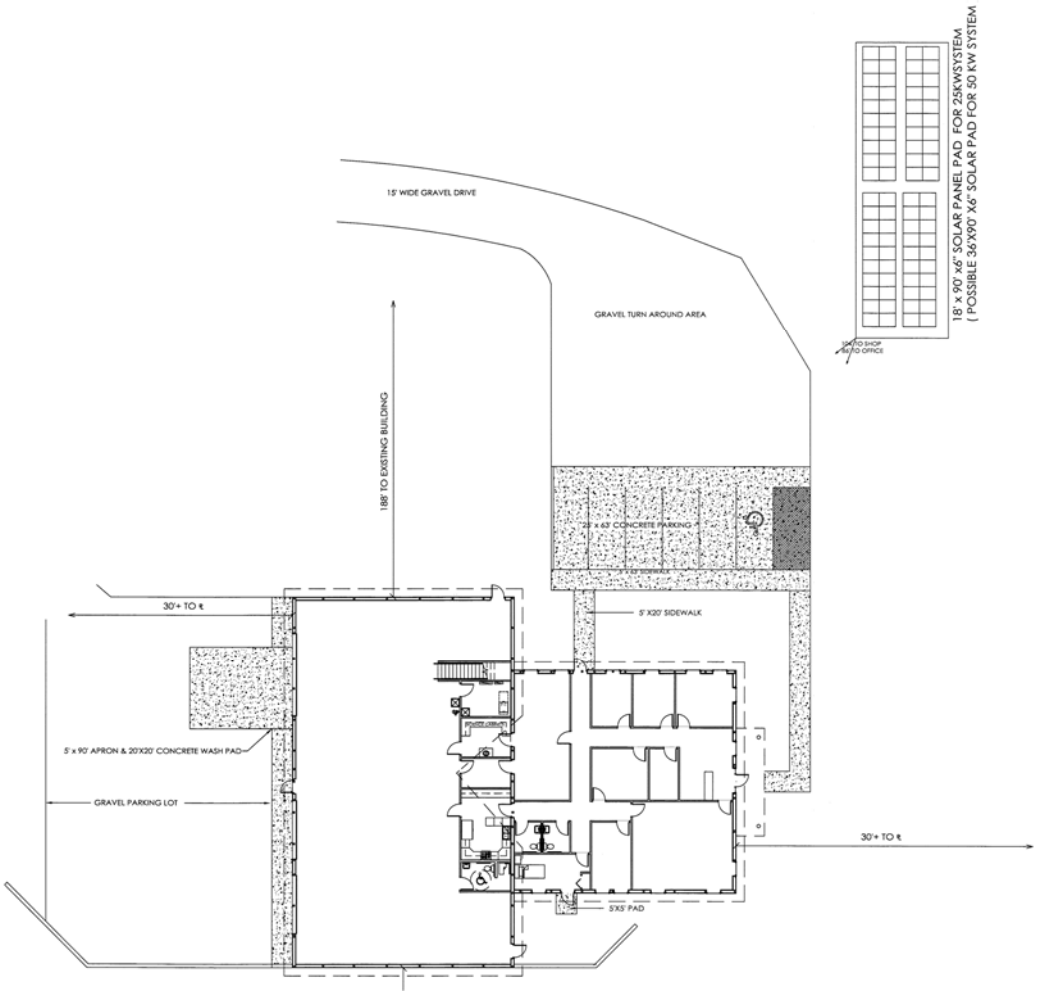
EMIQUON OFFICE AND MAINTENANCE SHOP

LEED CASE STUDY

BACKGROUND INFORMATION

Founded in 1951, The mission of The Nature Conservancy is to conserve the lands and waters on which all life depends. Our vision is a world where the diversity of life thrives, and people act to conserve nature for its own sake and its ability to fulfill our needs and enrich our lives.

In 2016, The Nature Conservancy received funding from Tellabs Foundation and began work with Farnsworth Group and Morton Buildings to design and construct a LEED-certified office with attached maintenance shop at its 6600 acre Emiquon Preserve in Lewistown IL. Much effort has been made to design and construct the most efficient and economical building practical. This project consists of an approximately 7,776 SF office and maintenance shop building. Spaces include multiple offices, a conference room, media room, several restrooms, a kitchen, Science room, along with several storage rooms, mechanical room and a three-bay garage with mezzanine.



FACILITY STATISTICS:

- ✓ 8,386 Total Square Feet
    - o Office 3600 Square Feet
    - o Maintenance shop 4200 Square Feet
    - o Storage Mezzanine 586 Square Feet
- ✓ Three each 400-foot-deep geothermal wells for heating/cooling office portion.
- ✓ Two each water to air two stage premium efficiency ground source heat pumps (7 tons total) serving the heating and cooling needs of the office area, each provided with integral variable speed pumps, and programmable controls
- ✓ An energy recovery ventilator extracting heat out of exhaust air and supplying fresh mechanical ventilation to the normally occupied spaces.
- ✓ High efficiency condensing tankless water heater.
- ✓ Biomass radiant floor heating system through office and maintenance portion of building as the first stage of space heating when available
- ✓ All LED lighting with automatic vacancy sensors
- ✓ Photovoltaic Array Size of 25 (KW)
- ✓ Rainwater storage (1000 gallons)
- ✓ Building envelope
    - o Wall R30 (42% better than baseline)
    - o Roof R47 (34% better than baseline)

DESIGN AESTHETIC:

Morton Buildings Inc. was selected to construct this building due to their superior product and unique ability to hit many of the LEED design standards. Morton's building system fits extremely well in the rural wetland landscape that is The Nature Conservancy's Emiquon Preserve and added design elements like timber framing for the front porch and versetta stone around the office provide a fitting look for the buildings surroundings.

SITE CONSIDERATIONS:

Emiquon, located in Fulton County near Lewistown Illinois, is one of the largest floodplain restoration projects in the Midwest. It is the premiere demonstration site for The Nature Conservancy's work on the Illinois River and within the Upper Mississippi River system and ultimately will help guide large floodplain river restoration efforts around the world. The Conservancy recently installed a water management structure as the next step in the restoration process. Additionally, Emiquon offers a wide range of recreational activities, from birding to paddling to hunting and fishing.

Emiquon, once was the jewel of the Illinois River, nurturing diverse and abundant communities of native plants and animals in the complex system of backwater wetlands and lakes. From the hundreds of nearby archeological sites, including Native American villages and ceremonial and burial mounds, to the acres of modern fields of corn and soybeans, this land is a quiet testimony to the abundant natural resources that supported more than 600 generations of civilization in this area.

The specific site selection on the 6600 acre Emiquon Preserve took into consideration public access, views, past, present and future restoration efforts along with cultural resources.

(PHOTO BY FRANK GOUDY)

LESSONS LEARNED

When did the project get stuck on accomplishing the goals, and how did you get beyond it?

The project team was challenged to figure out a way for the Geothermal system to operate at peak efficiencies while interfacing with the biomass radiant heating system. Working with mechanical engineers, the installer, manufacturers, Morton Buildings, LEED consultants from Farnsworth and staff from The Nature Conservancy, we were able to develop a system that met all project needs. Multiple meetings and conversations were required to gain a clear understanding of the mechanics of these systems. Working together as an integrated project team allowed us to overcome this obstacle and improve the building's operation.

What green approach failed on the project and what did you learn from it?

From the start of the project, we intended on meeting the credit SSc7.1 - Heat Island Effect – Non-Roof. We planned on using hardscape materials with an SRI of at least 29. In order to meet this credit, the project team selected white concrete and white gravel. Typical white concrete SRI values are provided in the LEED v3 Reference Guide, which states that

> *"Project teams do not need to provide project-specific data measuring SRI values for new concrete. Documentation certifying that the concrete mix used for a project is equivalent to a previously used and tested mix is acceptable."*

However, we did not perform adequate research into whether the documentation existed for the white gravel until it was too late. The manufacturer could not provide us with the SRI value, and the cost to get the gravel tested by an outside agency was deemed too high. Although the intent of the credit was met, the documentation was inaccessible, therefore we had to forfeit the point for this credit.

Our advice to future project teams would be to perform product research early in the pre-design phase. This will ensure teams select materials with sufficient documentation, and will avoid costly changes further into design or construction.

What will you always remember about this project?

We started this project with a simple goal of LEED certified, but it became clear very quickly that with Farnsworth's expert consulting, Morton's superior buildings and The Nature Conservancy's design choices, that the building would reach much higher. It demonstrates when you commit and work as a team you can far exceed your expectations.

What green feature will you incorporate on your next project?

We are thrilled with all the green features, but I think the biomass heating system that takes advantage of our need to cut down invasive tree species and using them to heat the entire facility is a must have in our next project.

What are you most proud of when you drive by the completed project?

Everything! We needed a facility that accommodated office and maintenance shop facilities and we didn't have a lot of examples to work from. Our first requirement was that it needed to be functional but it also needed to be efficient to operate and have an appearance that blended with the landscape. This building does it all.

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LEED EDUCATION TOUR

ENERGY AND ATMOSHPERE

GEOTHERMAL: Ground source heat pump systems are considered a renewable energy source according to the Department of Energy and Environmental Protection Agency, generally using around 50% less energy than baseline-efficient systems. The hidden gains that energy extracted from one space can be inserted into the next space. Also, unneeded energy is stored in the ground for later use.

The heating and cooling for the office portion will utilize three 400 foot deep closed loop wells that will transfer heat to/from the water to air heat-pumps and deliver space heating and air-conditioning to the occupied spaces. The heat-pumps selected are dual stage to take advantage of avery high part-load operating efficiencies, maximize run times for improved service life, and provide all the instantaneous capacity necessary for the most extreme conditions. The heat pumps are provided with integral variable speed pumps which operate only when the heat-pump compressor is enabled and maintain an optimized water side delta T across the heat-pump maximizing efficiency and removing the need for central pumping and associated required DDC type temperature controls. The heat-pumps are controlled via programmable thermostats which are provided with optimized start, night setback, and heat-pump troubleshooting capabilities. The performance of the system is just as dependent upon the geology as the heat pumps themselves. We modeled these systems over the course of 20 years targeting 0 °F change in ground temperature, sizing the ground loop to ensure our impact is near zero. The site's ground performance is excellent with a tested thermal conductivity of 1.79 btu/(h*ft*°F) and an undisturbed soil temperature of 55.9 °F.

Modern well-constructed building envelopes provide buildings which do not naturally breathe, so it's necessary to provide mechanical ventilation. This facility uses an Energy Recovery Ventilator for occupied ventilation, ensuring that valuable heat is not lost through exhaust, but rather transfer to pretreat the OA ventilation coming in. This keeps the building fresh without sacrificing valuable heat.

BIOMASS RADIANT FLOOR HEAT: Part of the responsibility of The Nature Conservancy on the Emiquon Preserve is the removal of invasive tree species. This provides a natural opportunity to turn the removal of invasive trees into fuel for the project facility. This innovation in design was identified by The Nature Conservancy and implemented by the design team.

The wood-fired boiler will help to offset the total heating load, and reduce the anticipated required Photovoltaic array (Solar Panels) from 25 kW to an estimated 20kW. That's taking advantage of integrated design!

Recognizing the fire must be attended at times when the facility may not be occupied, The Nature Conservancy has implemented a 25 kW PV array (Solar Panels). When the wood-fired boiler is not in use, ground source heat pumps provide an extremely efficient automatic back-up.

(Photos by Jason Beverlin)

PHOTOVOLTAIC ARRAY (SOLAR PANELS): An on-site PV system is one of the most readily available technologies for on-site energy production. Its low maintenance, high reliability and ability to provide back-up when necessary makes it an attractive approach for The Nature Conservancy. The technology also provides a highly visible and commonly understood commitment to renewable energy. We have determined a PV array of 25 kW will satisfy the net zero energy use for the site, including the outdoor wood-fired boiler.

(Photo by Doug Blodgett)

SUSTAINABLE SITES AND WATER EFFICIENCY

RAINWATER STORAGE: A 1000-gallon rainwater storage tank will collect water underground from the roof. This water will then be used to rinse off restoration equipment such as boats and tractors after

usage that will not only help keep equipment clean and in working order, but can also help contain the spread of some invasive species.

LANDSCAPING: The yard will be planted with buffalo/blue gramma grass for the yard. Landscaping will use chokeberry bushes and clumps of purple coneflowers. The tall grass prairie beyond the yard will be a prairie mix, heavy on showy forbs. All plant species are native, therefore they will not require any irrigation. Planting native species helped the Nature Conservancy to protect and restore the habitat, while also keeping water usage low by eliminating the need for irrigation.

INDOOR ENVIRONMENTAL QUALITY

BUILDING ENVELOPE: The Architect has primary design responsibility for the building envelope. With a tight building envelope, including walls >R30 (42% better than baseline) and the roof >R47 (34% improvement), the building envelope is certainly doing its part. It's important in buildings with super tight envelopes that we provide a controlled, reliable means for the building to breathe. Accomplishing this through an Energy Recovery Ventilator helps ensure that we extract energy out of the air being exhausted and transfer to incoming fresh air.

(PHOTO BY TIMOTHY PYRTLE)

MATERIALS AND RESOURCES

RECYCLING PLAN: Recycling has been a normal part of our operation long before our new building and continues. We meet LEED requirements, recycling paper, corrugated cardboard, glass, plastics, metals

and batteries. To keep it simple and easy for staff to use, all recycling except batteries, is placed into one bin and separated at the recycling facility. This makes compliance easy, efficient and effective.

REPURPOSED MATERIALS: The reception desk and accent wall located in our reception room is made of recycled and salvaged materials including wood and steel salvaged from buildings within a 200-mile radius of our project site. The look and feel of these repurposed materials are perfect for our setting and gives them a second or third life representing our commitment to sustainability.

(Photos by Jason Beverlin)