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A Great Building for Great Research

Woods Hole Oceanographic Institute and the Scripps Institution of Oceanography are known worldwide for leading research and education on the oceans. Dr. Dale Chapman looks forward to the day when the National Great Rivers Research and Education Center is similarly famous as a center for research on great river basins. >

If the creative design of the center's field station is any indication, the National Great Rivers Research and Education Center (NGRREC – pronounced N-GREK) will have a leading role in developing a deeper and fuller understanding of how river systems work.

Chapman is president of Lewis and Clark Community College, which partnered with the University of Illinois, the Illinois Natural History Survey, and the U.S. Army Corps of Engineers in 2002 to found the NGRREC.

This is the most comprehensive facility in America to study the Mississippi River, which drains 41 percent of the United States and is 3,000 miles long, Chapman said. The NGRREC unites engineering, environmental sciences, and social sciences under one roof to study environmental issues, energy, commerce, and human interaction with the fourth largest watershed in the world. We need to understand the river to sustain our economy and maintain biodiversity and water quality, Chapman said.

While meeting the facility needs of over 30 research scientists and their assistants, the field station in Alton, IL, is designed to look like some of the bluffs that line the Mississippi River: layers of stone topped by dirt and plants. At the same time, the facility was designed to pass a high threshold for sustainability – one goal was a LEED (Leadership in Energy and Environmental Design) platinum building rating. The NGRREC is not hooked up to any municipal sewer system, instead it treats all of its waste water and storm water on site, and it is intended that the facility will generate all of its own electricity from wind and hydrokinetic water turbines.

The 35,000-square-foot first phase was completed recently and dedicated on October 26, 2010. Additional phases will add another 25,000 to 30,000 square feet to the facility. Site work has already begun for the 15,000-square-foot second phase.

An Audacious Bluff

The design intent was to mimic the Mississippi River bluffs with a structure that flows with the land. The building is designed to blend in with its surroundings and look natural. So, we have everything on a radius – no square corners, dry stacked layers of stone, and minimal windows – none on the front of the building, said Erin Morris, construction manager for AAIC, the project architect and engineer.

The result is a unique exterior system with walls varying in thickness from two feet to six feet.

Poured in place concrete is not unique, but we have a poured in place concrete wall

that is 12 inches thick, then a 12-inch grout cavity, then dry stacked stone, he said. There is dry stacked stone inside the lobby, too, so the exterior lobby wall is the thickest in the building with two grout cavities and two layers of stone. In the other areas, the interior side of the exterior wall is furled out and covered with insulation and drywall.

In keeping with their naturalistic design, the architects didn't want any mortar joints between layers of stone. AAIC came up with a system that used standard masonry hangars. The stone was dry stacked in front of the hangars and grout was poured in from the top. The grout would flow into spaces between the stone and grip it like fingers.

The stone was very unusual, and obviously took a lot more time, said Kent Kampwerth, project manager for River City Construction LLC, the general contractor. We couldn't lay much at a time, but we had a concrete wall behind it, so it didn't affect the constructability. We could work on the inside without the outside being done, he said.

An Unusual Roof

The roof was engineered by Foresight Engineering and is covered with a Carlisle vegetative roofing system. It, too, was unique. The Center for Environmental Innovation in Roofing recognized it with a 2010 Excellence in Design Award.

Most green roofs are trays with plants in them, not full blown dirt roofs like this one, Kampwerth said.

Roofing Services and Solutions, formerly the Young Group, installed the 24,000-square-foot roof. Joseph Lauberth was the project manager for RSS.

We used a full Carlisle system from the deck up, he said. We started with a two-ply waterproofing system over the concrete deck – a fleece-backed Carlisle modified base sheet – which we adhered with a Type III asphalt adhesive. Then we installed a 105-mil EPDM membrane, protective fabric, a MiraDrain drainage system, insulation, a 40-mil geomembrane root barrier, Enkadrain, 12 inches of engineered Carlisle Growth Media, and native prairie grasses, he said.

The insulation was tapered to give the roof an undulating look, like a natural bluff, he said. The thickness of the insulation varied from four inches over the main part of the building to nearly four feet over the garage.

The garage structure is four feet lower than the rest of the building, so we had to raise it up with insulation to even it out, Lauberth said. In that area, that top of the growth media can be five to six feet higher than the concrete deck, he said. >

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Project Team

National Great Rivers Research and Education Center Team

Owner

Lewis and Clark Community College
University of Illinois
Natural History Survey
U.S. Army Corps of Engineers

Architect

AAIC Incorporate

Civil Engineer

Sheppard, Morgan and Schwaab, Inc.

Structural Engineers

EDM Incorporated

MEP Engineers

AAIC

Roofing Consultant

Foresight Services, Inc.

General Contractor

River City Construction LLC

Major Subcontractors

Bel-o Plumbing and Mechanical
Loellke Plumbing
Pyramid Electrical Contractors
Automatic Fire Sprinkler Co.
France Mechanical
Roofing Services and Solutions
Diecker-Terry Masonry

Part of the roof top is designed to serve as an outdoor classroom and observation deck. Even though the concrete pavers there appear level, some are on the roof deck and some are 18 inches off the roof deck, Lauberth said. The concrete structure is tapered for drainage. We used a laser level and screw jack pedestals to level the pavers, he said.

There is a whole lot more that went into that roof than it appears. It is truly unique, Lauberth said.

Carlisle warranties the system for 15 years. An electronic field vector mapping system was installed after the waterproofing membrane to detect possible future leaks. If there is a problem in the future, they can plug it in and charge it and then with a meter they can locate voids as small as pinholes, Lauberth said. And that will minimize the cost of repairs.

The concrete roof structure is very heavily reinforced to support the weight of the green roof and the walls are reinforced to resist the lateral pressure of the earth and stone on them, said Gary Neuhaus, project manager for the structural engineer, EDM.

Water

Moving from the shell to the building systems, the water efficiency items were the biggest sustainability features, Morris said.

The NGRREC has four water systems: potable water for drinking, a stormwater

collection and reuse system, a sanitary sewage system, and a river water system.

Since the facility is designed for river research, there is a piping system to pump 1.8 million gallons of water per day out of the river into mesocosms – culture systems for fish larvae. The NGRREC will also use river water in its chiller system – after running it through a green machine that filters and descales it.

An onsite sewage treatment system will treat 100 percent of the wastewater by running it through biological filters – constructed wetlands – and treating it with ultraviolet light and chemicals, after which it can be reused to flush toilets.

Stormwater will be collected and used for irrigation and to wash cars and boats.

It was a challenge to incorporate everything onto the site. With this site we definitely had to reserve area for the wastewater system and position everything so that it had enough area, including ditches and ponds for stormwater detention, said Cas Sheppard, president of civil engineering firm Sheppard, Morgan and Schwaab, Inc.

We hadn't had a lot of experience with the pervious concrete pavers used on the road, with detention below and infiltration into the soil. We weren't sure you could put concrete trucks and other heavy trucks on it, but the contractor who put it down does them nationwide and he said not to worry, that you can put 18-wheelers on them. In fact, they've had deliveries that way and it has carried the loads, said David Godar, Sheppard, Morgan and Schwaab's project engineer.

Power

The second biggest sustainability feature is the onsite power generation, Morris said. Two 100-kilowatt wind turbines will be erected during the next six months, as will a barge to house hydrokinetic turbines.

They will be able to run eight different turbines at a time in the barge, Morris said. The NGRREC will be the first national test site for hydrokinetic turbines. Once the wind turbines and hydrokinetic turbines are on line, the NGRREC will be off the grid, Morris said.

Other sustainability features include VAV (variable air volume) units in every room to manage heating and cooling for each room separately, a heat recovery wheel and peak ice storage on the HVAC (heating, ventilation, and air conditioning) system, 65 solatube daylighting tubes to bring daylight into the interior of the building and reduce the number of light fixtures, and dual ballast light fixtures connected to photosensors and occupancy sensors.

The big thing is the automation, the light meters and occupancy sensors, to turn lights off when no one is in a room and reduce lighting levels when there is daylight, Morris said.

The flooring is made from recycled rubber; the rebar and steel studs were made with recycled steel, the insulation is made from recycled newspaper; glass tiles and solid surface countertops are made from recycled glass.



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Confluence Field Station
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