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# GREENSBURG

The Green Rebirth of a Kansas Community





## CREDITS

We would like to offer thanks those who have contributed to the rebirth of the town of Greensburg, Kansas and the new school facilities, including all of the wonderful students, council members and other members of the Greensburg community.

### **Greensburg Unified School District 422**

Darin Headrick  
Randy Fulton  
Staci Derstein  
USD 422 School Board Members

### **City of Greensburg, Kansas**

Steve Hewitt, City Administrator  
Bob Dixon, Mayor  
John Janssen, Former Mayor

### **State of Kansas**

Honorable Kathleen Sebelius, former Governor  
Honorable Mark Parkinson, Governor  
Steve Weatherford, Governor's Liaison  
Dennis McKinney, Kansas State Treasurer  
Terry Woodbury, Kansas Communities

### **Federal Emergency Management Agency (FEMA)**

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### **National Renewable Energy Laboratories**

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Lynn Billman

### **United States Department of Agriculture - Rural Development (USDA)**

Chuck Banks, Former State Director of Rural Development

### **U.S. Environmental Protection Agency**

David Doyle  
Chilton "Chet" McLaughlin

## PROJECT TEAM

Architect - BNIM  
Educational Planning Consultant - Armstrong Torseth Skold & Rydeen, Inc.  
Construction - McCown Gordon Construction, LLC  
Landscape Architect - BNIM  
Mechanical/Electrical/Plumbing Engineer - BGR Consulting Engineers, Inc.  
Structural Engineer - Structural Engineering Associates, Inc.

## IMAGERY

Courtesy of PlanetReuse: page 33 / Farshid Assassi, Assassi Productions: pages 8-9, 13, 19, 20, 21, 27, 28-29, 30, 31, 32, 36, 37 / BNIM: all others

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# **GREENSBURG**

The Green Rebirth of a Kansas Community  
Devastated by an EF5 Tornado



## BACKGROUND

On the night of May 4, 2007, an EF5 tornado nearly two miles wide ravaged the town of Greensburg, Kansas, resulting in a tragic loss of life, displacing more than 1,500 people and destroying 95 percent of the town's homes and businesses.

Over the last four decades this small rural farm town had been declining in population with a struggling economic base. In the wake of the disaster, it became apparent that big changes would have to occur to sustain the town for future generations. The community set out to rebuild a prosperous future by making Greensburg a socially, economically and environmentally sustainable city. The Greensburg City Council approved a resolution that all city building projects will be built to LEED Platinum standards, the highest level of sustainable certification offered by the U.S. Green Building Council. As the first city in the United States to do this, Greensburg is providing a model for rural America for the 21st century.



BEFORE



AFTER



## **PROCESS**

During the recovery effort, the public involvement process emerged as one of the most important factors that led to a unified community vision and goals, high performance design and successful implementation. Over 300 people gathered under a large tent raised on the east edge of town, eager to share their ideas for rebuilding. The tent remained a community gathering space throughout the recovery process, hosting several design workshops, community meetings, and even Sunday morning church service.



Blessed with a unique opportunity to create a strong community devoted to family, fostering business, working together for future generations.

## CITY OF GREENSBURG GOALS

### 01: COMMUNITY

A progressive community that offers urban services within the unassuming feel of a rural, Midwestern community.

### 02: FAMILY

A community that provides opportunities for its young people in the way of jobs, education and recreation as reasons to stay in Greensburg.

### 03: PROSPERITY

A community where entrepreneurial spirit, customer service and a sustainable economy permeates the business sector and where residents, travelers and tourists enjoy a full line of locally-owned businesses that provide jobs and services to an exceptional example of smalltown America.

### 04: ENVIRONMENT

A community that recognizes the importance of the natural environment and balances the need for growth and economic development with the maintenance and improvement of the environment.

### 05: AFFORDABILITY

An up-to-date, affordable rural community where housing plans and strategies incorporate energy-efficient design and materials and serve as a regional and national model for integrating residents of all ages and needs with services of all kinds.

### 06: GROWTH

A community that opens its doors to new residents and visitors without affecting the values and lifestyles of its current residents.

## 07: RENEWAL

A community that makes proactive decisions and uses this opportunity to reverse the decline of the community and build a progressive city with a strong future.

## 10: ENERGY

A community that promotes a high level of efficiency in new construction and look to renewable options for generation.

## 08: WATER

A community that treats each drop of water as a precious resource.

## 11: WIND

Greensburg's vast wind resources are part of an emerging economy and should be harvested.

## 09: HEALTH

A community that improves quality of life by promoting a healthy and active lifestyle.

## 12: BUILT ENVIRONMENT

Build a town that encourages interaction between residents, welcomes guests and serves as a model community. New development should be durable, healthy and efficient. City projects will lead the way by becoming examples of green practices that are built to last.





## GENERAL SCHOOL DESIGN CONSIDERATIONS

### ELEMENTARY EDUCATION

Environments specifically designed for young learners have a common purpose: enhancing the exchange of information, stimulating curiosity and the examination of facts, and acting as catalysts to encourage creative thinking in the most formative years of young adults. These endeavors are all supported by thoughtful planning, understanding of technological possibilities, and attention to the character and quality of spaces.

### MIDDLE SCHOOL EDUCATION

Middle School Education is often the largest challenge for educators, as they usher children from childhood to be more responsible young adults. The physical environment can enhance this educational process in a variety of ways.

### HIGH SCHOOL EDUCATION

In order to address the multiple needs of 21st century high school facilities, flexibility is key, whereby different education philosophies are allowed to pervade the physical environment in a successful manner as needs, and educational approaches, change over time.

### TECHNOLOGY

K-12 facilities should be state-of-the-art with fiber-optic technology and the possibility

to integrate new ideas as the increasingly important role of technology is addressed in the design and planning.

### FLEXIBILITY

K-12 educational facilities should be flexible to accommodate numerous grade configurations. They should also integrate current educational technology while anticipating future advances in technological tools. Additionally, community spaces can have multiple configurations, so that they can have multiple uses.

### SUSTAINABLE DESIGN

Sustainably designed facilities have a positive impact on occupants not only through the benefits of daylight and healthy materials, but also by embracing a healthy respect for our environment that permeates their daily lives. For a school district, there is the benefit of lower operating costs and maintaining a facility that is durable and designed to last for many decades.

### PLANNING FOR THE FUTURE

The planning process for 21st century schools should accommodate the potential for various curriculum configurations and should include the use of educational technology. By addressing the influence of technology upon

teaching and learning early in the planning stage we can engage its benefits.

### COMMUNITY USE

Schools have long been hubs of community activity. In daily life, or even at times of disaster, they serve a critical function. A wide variety of community-use spaces should be provided to invite social involvement that is so beneficial at the high school level. Fitness and athletic spaces meet a community's social and recreational needs. Spaces that accommodate adult education and senior citizens activities should be considered.

### EDUCATIONAL GOALS/COMMUNITY VISION

Above all, the design of a school should embrace full participation during the planning phases by all stakeholders of the facilities. As the center of the community, the schools must respond to both educational goals and community interests.

### OTHER KEY ISSUES

There are numerous other considerations when designing educational environments such as: student and faculty security within the building, site and vehicle security, future expansion, and operations and maintenance, just to name a few.



Controlled natural daylight, access to outdoor views, indoor air quality and acoustics all have an impact on students' mental alertness, productivity and psychological well being. According to the ground-breaking *Heschong-Mahone Report*, daylighting in classrooms is strongly linked with student performance in Math and Reading.

# Designing for the Future

The vision for the new Greensburg School was that it should serve as a lasting tool for the students and faculty, a steward of the town's resources—both environmental and financial, and a symbol of renewal and perpetuity long into the future. Like all new civic buildings in the rebuilt town, the new school was designed to achieve LEED Platinum, a commitment that will bring financial returns to the school district year after year.

# Focus on the Students

Throughout the design process, every decision was weighed against a single question: **How does this benefit the students?** The Greensburg student was at the heart of all design strategies, each material selection, every project meeting and all allocations of funds. The result is a new Greensburg School that truly responds to the needs of each student and exemplifies the spirit of the student community.

“This is AWESOME!  
This is the opportunity of a  
lifetime – not even a lifetime...  
of 500,000 years!!”

LEVI SMITH, GREENSBURG STUDENT

LABORATORY



## A PLACE FOR THE COMMUNITY

Anyone who visits the town of Greensburg, Kansas comes away with a sense of the tremendous connections that the town residents share with each other. A Friday night football game brings the whole town together. High school graduation affects nearly everyone in the community. A town meeting really is a town meeting.

The new Greensburg School is more than just a place for students to learn. This school is a community hub. It is a place for the town's youths to interact. It is a backdrop for community-wide celebrations and activities. The library serves all citizens, and the cafeteria doubles as a gathering space for large-scale events like ball games. And, just as the school invites the community inside, the town shares venues like the town auditorium with the school to encourage density, connection and consolidation.



## THE MODERN CLASSROOM

Today's classrooms are expected to be so much more than just rooms. They are carefully designed teaching tools that have quantifiable impacts on how well students learn.

### BUILDING SYSTEMS & MATERIALS

Studies show that natural daylight, acoustics and indoor air quality have profound effects on test scores and student health. As a result, our new classrooms today pull sunlight deep into interior spaces; they control sound pollution from room-to-room, hall-to-room and within each room; they are well ventilated; and they utilize interior finishes with little or no off-gassing.

### TECHNOLOGY

Students in the 21st Century grow up in environments equipped with the latest technological learning tools. The modern classroom offers computer or docking stations, Wi-Fi, integrated projection systems and SMART Boards™. Additionally, furniture systems for classrooms are now designed to be modular and flexible to meet spontaneous configuration needs.

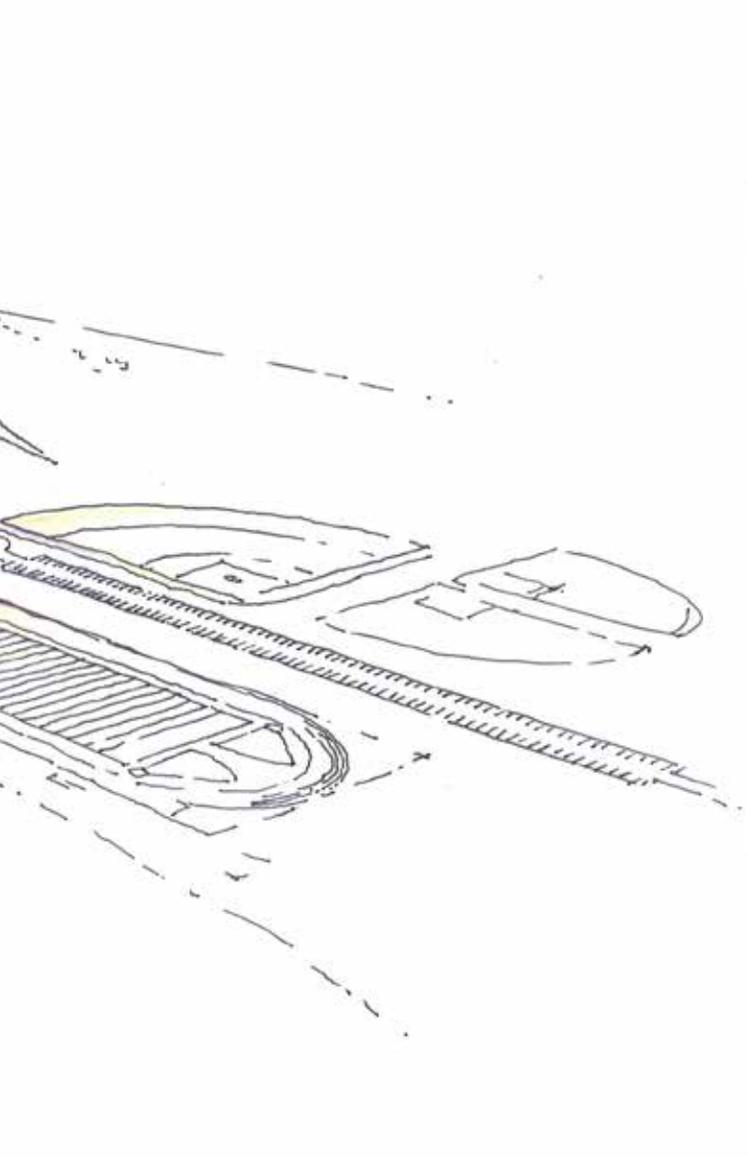
### PEDAGOGICAL SPACES

Learning spaces are, themselves, becoming objects of study. As buildings become smarter—integrating systems like green roofs, rainwater harvesting, vegetable gardens, composting areas, etc.—they are seen more and more as opportunities for learning and teaching. Schools are now looking for ways to introduce the study of their buildings, landscapes and practices into curriculums.





## DESIGN APPROACH

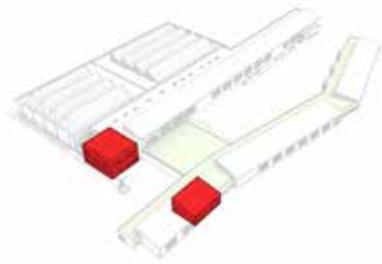


Though the obvious function of this facility is to serve as a high-performance environment for teaching and learning, the new Greensburg School also plays an important role in the greater Greensburg community and physical context.

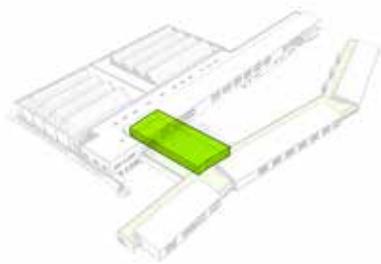
The new school's site was selected as part of an initiative to strengthen Greensburg's density and the fabric of development along Main Street. Other criteria served as even stronger influences: the ability of students and staff to safely walk and bicycle between home and school; the availability of basic services within walking distance of the school; and the ability to share theater, meeting space, athletic fields and other facilities between Greensburg and the larger community. Although other sites were available, only 600 South Main Street met all these criteria.

The parti was based on the idea that, as a K-12 school, the building should provide separate zones for prekindergarten and kindergarten, elementary (grades 1-5), middle (grades 6-8) and high school (grades 9-12) students to provide for the unique learning and social needs that each age group requires; yet, the school was also carefully designed to integrate the students at key times and places to build a sense of community, encourage mentorship and instill a desire for achievement and progression through the school.

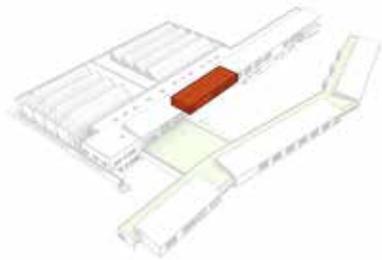
## DESIGN DEVELOPMENT : LAYERS OF DESIGN



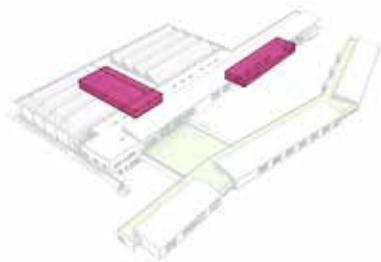
ADMINISTRATION



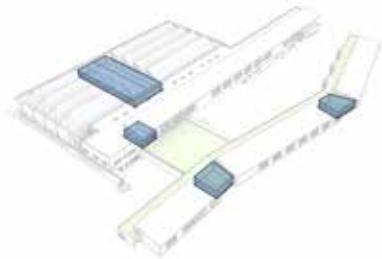
GREEN ROOF



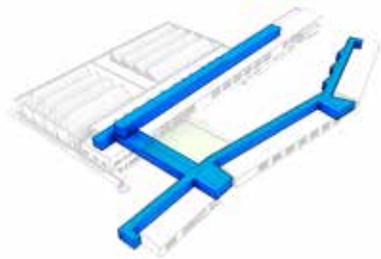
SHARED SPACES



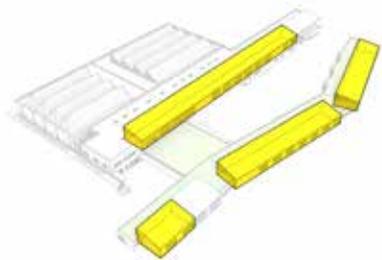
SUPPORT AREA / STORM SHELTER



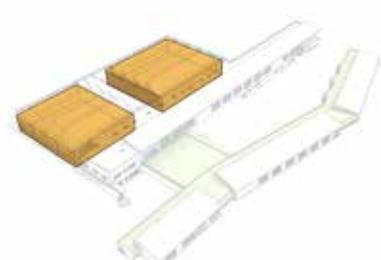
COMMUNITY SPACES



CIRCULATION



CLASSROOMS



GYMNASIUMS

The building's 126,129 square feet will accommodate 350 students in its teaching facilities. Supporting facilities include the adult learning center and media center with media support rooms, two distance learning classrooms, an art classroom with an outdoor deck and kiln room, two music classrooms, three science labs with support spaces, three special education areas, cafeteria and kitchen facilities, and separate administration areas for the elementary and middle school, high school and Superintendent of schools. Located directly adjacent to the school is a separate industrial arts building housing wood and metal shops. Several outdoor educational areas have also been designed; a school vegetable garden and kitchen composting area to the east of the school, a future amphitheater in the central courtyard and a future rooftop garden and terrace over the adult learning and media centers (accessible from the high school).

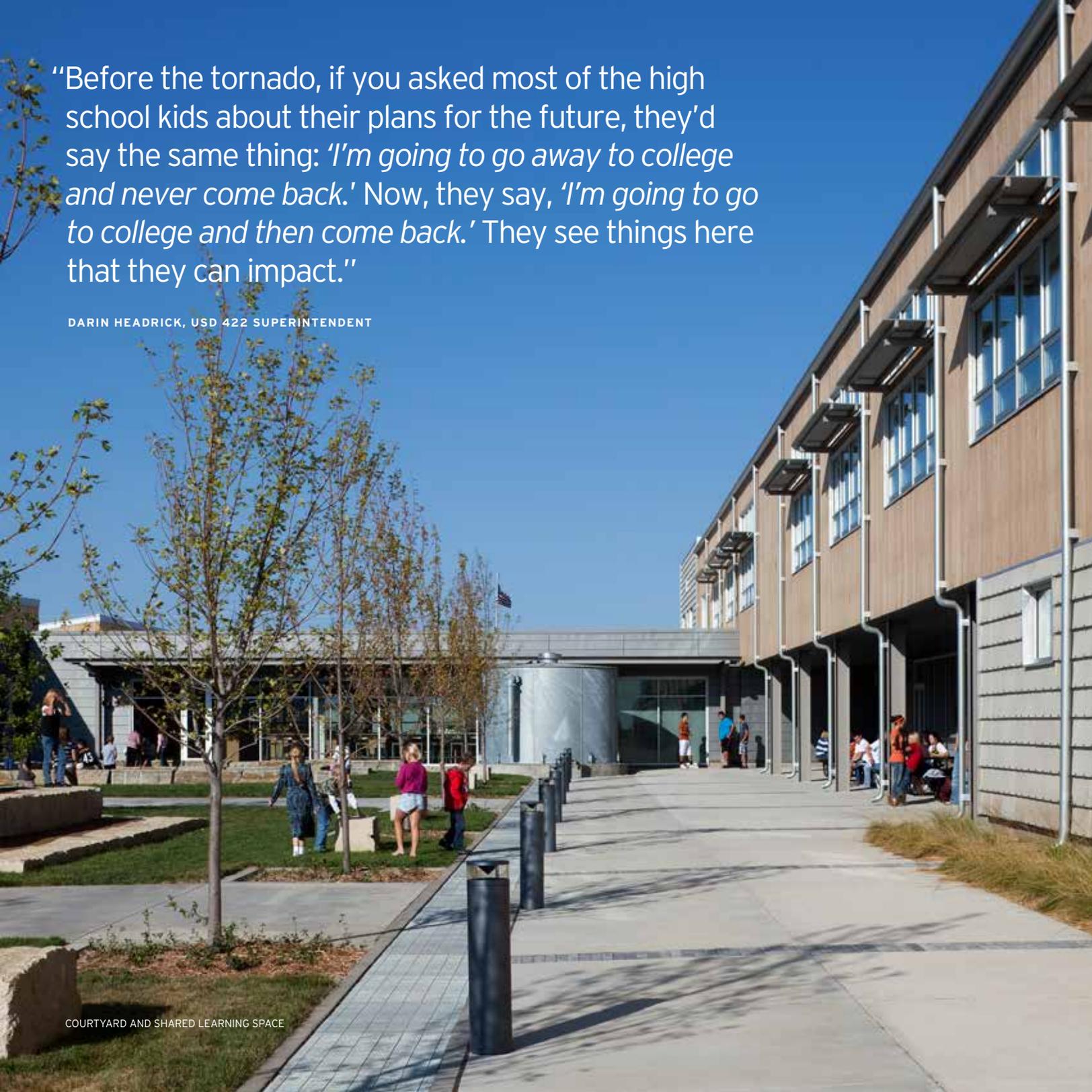
Two new gymnasiums are included in the school campus as well. The main gym seats 1,232 fans, and the auxiliary gymnasium seats 630 fans. Gymnasiums are provided with both basketball and volleyball equipment including scoreboards. Connectivity for televising games has also been provided. Four locker rooms, offices and a training room are located between the gymnasiums. The weight room and equipment storage areas are adjacent to the main gymnasium.

The facility also includes an above-grade, FEMA-compliant storm shelter large enough to accommodate the entire population of the school.

*“Before the tornado, if you asked most of the high school kids about their plans for the future, they’d say the same thing: ‘I’m going to go away to college and never come back.’ Now, they say, ‘I’m going to go to college and then come back.’ They see things here that they can impact.”*

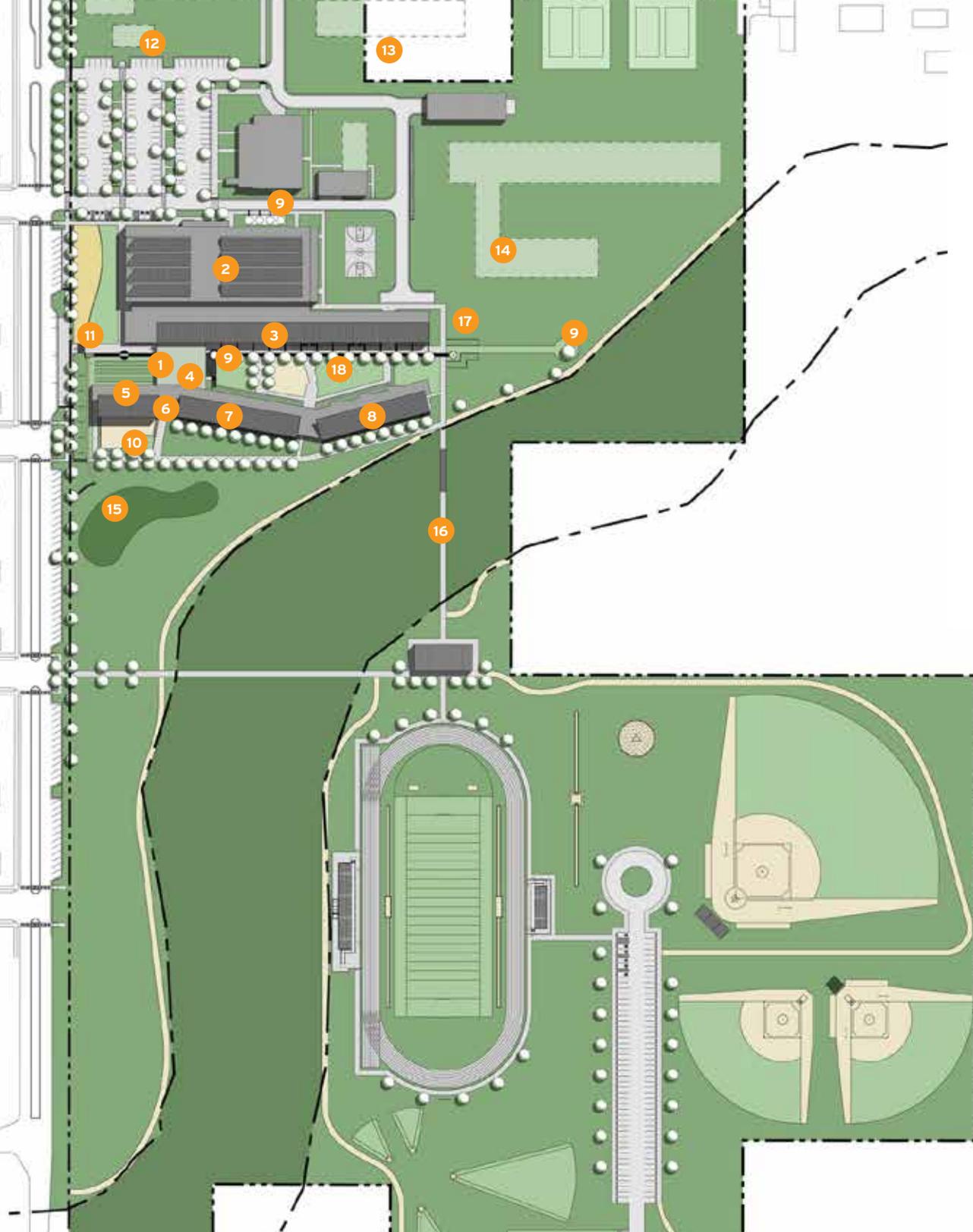
DARIN HEADRICK, USD 422 SUPERINTENDENT

COURTYARD AND SHARED LEARNING SPACE









- 1 District Admin (Level 1)  
High School Admin (Level 2)
- 2 Gymnasium / Auditorium
- 3 Shared (Level 1)  
High School (Level 2)
- 4 Media Center
- 5 Preschool / Kindergarten
- 6 Elementary Commons / Admin
- 7 Elementary School
- 8 Junior High School
- 9 Rainwater Cisterns
- 10 Playground
- 11 Main Entry
- 12 Future City Offices / Pool
- 13 Future Youth Center
- 14 Future School Addition
- 15 Future Constructed Wetlands
- 16 Pedestrian Walkway to School
- 17 Future Greenhouse
- 18 Learning Gardens



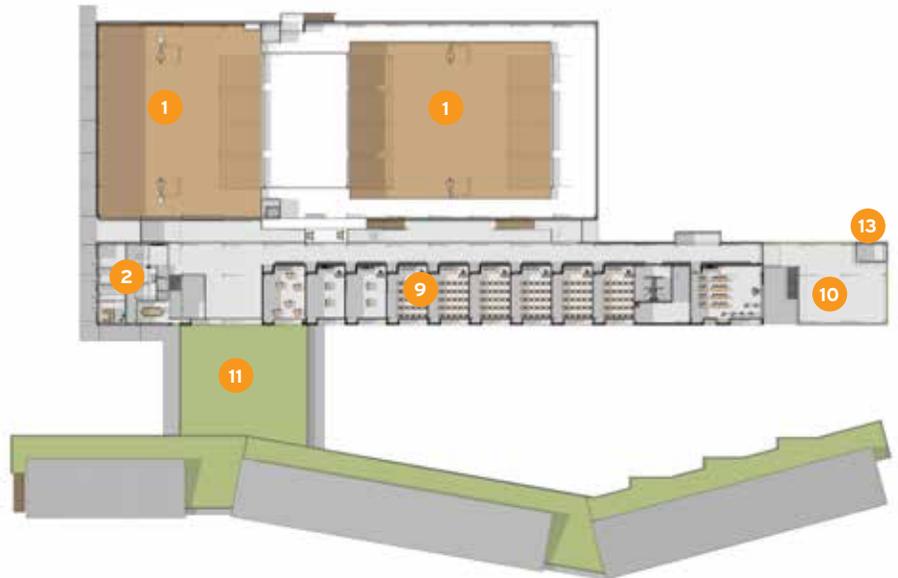
SITE PLAN

- 1 Gymnasium
- 2 Administration
- 3 Main Entry / Media Center
- 4 Public / Shared Spaces
- 5 Music Room
- 6 Pre-School / Kindergarten
- 7 Elementary
- 8 Junior High
- 9 High School
- 10 Outdoor Terrace
- 11 Green Roof
- 12 Courtyard
- 13 Kiln

0 50 100 150 FT



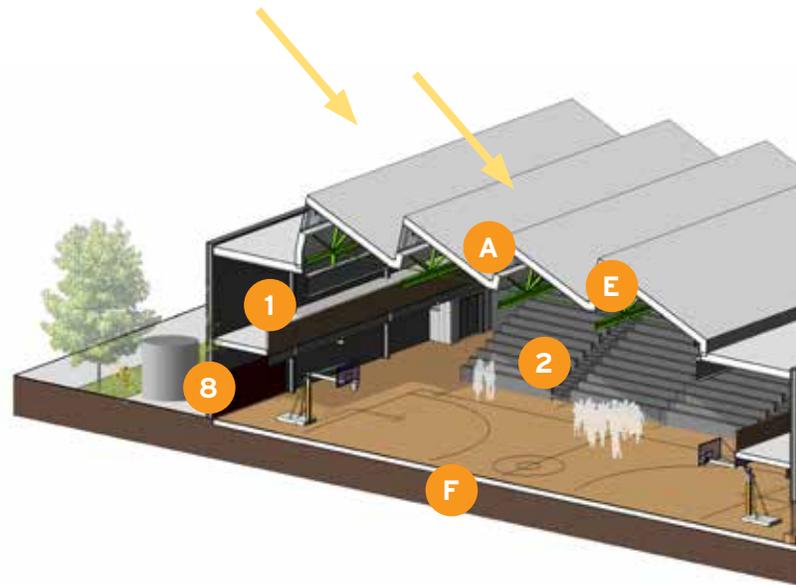
LOWER FLOOR PLAN



UPPER FLOOR PLAN

## THE BUILDING SYSTEM

One of the major client directives for the Greensburg School's design was to provide optimal daylighting conditions to all classroom spaces and to also provide natural ventilation to each classroom. The District is firmly committed to creating the best learning environment and adheres firmly to the importance of daylighting as a key factor for increasing student academic performance/potential and focus in the classroom. The goal was to create classrooms, that during normal school hours, would be lit entirely by natural light. Additionally the daylighting would be controlled in such a manner that it would not create unwanted glare in the classroom or heat gain - no matter the time of day or season of the year.

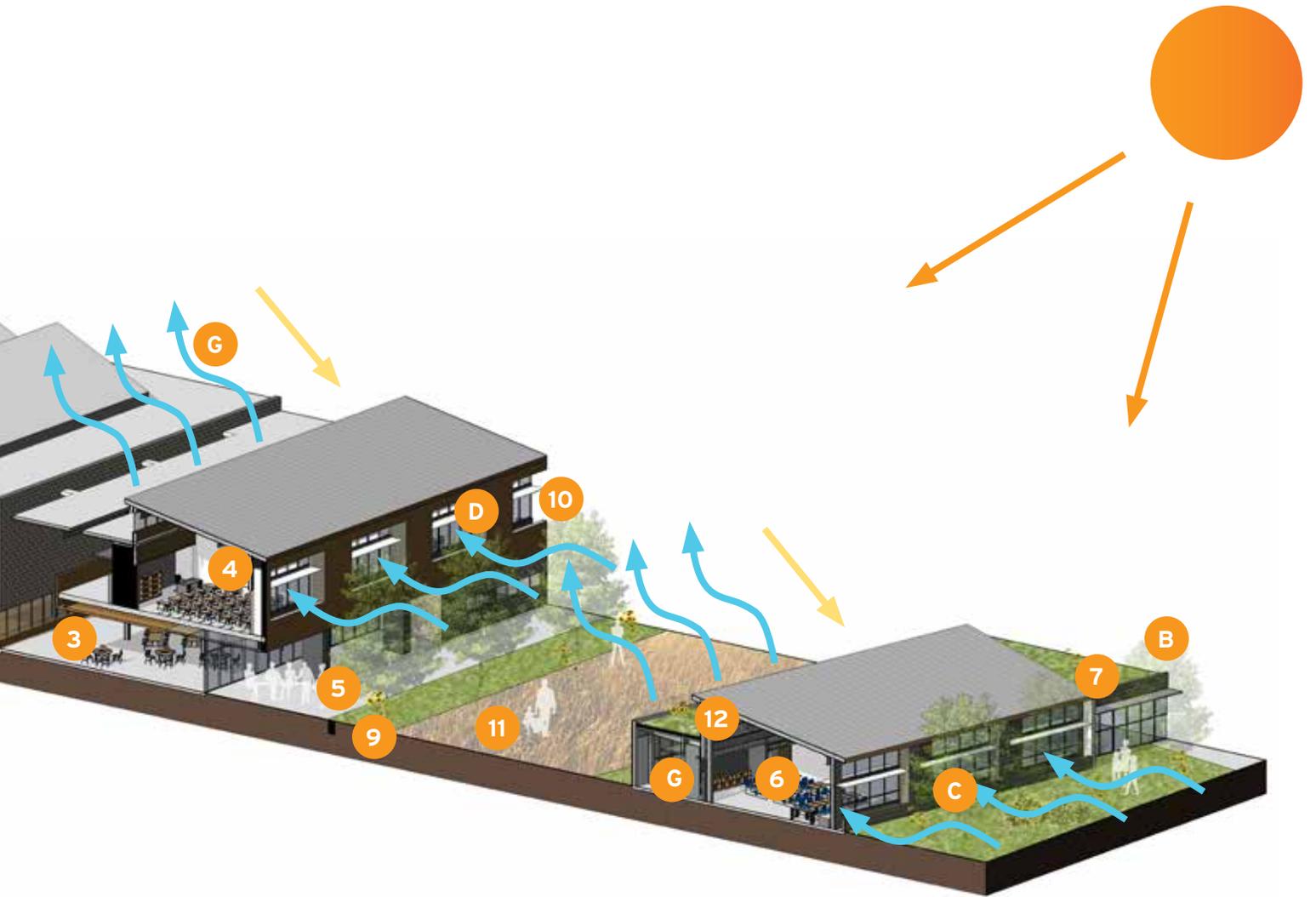


- 1 Indoor Track
- 2 Gymnasium
- 3 Shared Space
- 4 High School
- 5 Courtyard and Outdoor Classroom
- 6 Elementary
- 7 Green Roof
- 8 Water Cistern
- 9 Rainwater Catchment Trough
- 10 Exterior Light Shelf
- 11 Indigenous Planting
- 12 Clerestory Windows

 Path of Natural Lighting

 Path of Natural Ventilation

- A All rainwater is collected from roof surfaces, and are captured and filtered in a series of above ground and below-ground cisterns
- B Deciduous trees provide summer shading and light filtration
- C Low operable windows to capture prevailing winds (from the SW) to enter the room low and freely flow through the room and exit high in the space at the clerestory to allow natural cooling when conditions permit
- D Exterior perforated sun shading devices, interior light shelves and roller shades enable control of the amount and quality of daylight entering classrooms and other interior spaces to nearly eliminate the need for artificial, electric light during normal school hours
- E North-facing clerestory to optimize daylighting to gymnasiums
- F Long E/W axis wings with single-loaded classroom allow the design to optimize access to south and north daylight
- G Naturally-lit corridors with operable windows





SOUTH ELEVATION



WEST ELEVATION

“The city of Greensburg has taken the extraordinary step of committing to rebuild their community to a new vision, not settling for simply recreating what had gone before. By committing to a recovery plan based on green building, the community’s leadership has set a path that will result in a healthier, more livable city for its citizens, turning a crisis into an opportunity that is an example for us all.”

RICK FEDRIZZI, PRESIDENT, CEO & FOUNDING CHAIR, U.S. GREEN BUILDING COUNCIL



“The biggest success story in Greensburg, to me, has been the resiliency and determination of our citizens to make a difference in their world. We’re new pioneers in the sustainability movement.”

BOB DIXSON, GREENSBURG MAYOR



SCHOOL ENTRANCE

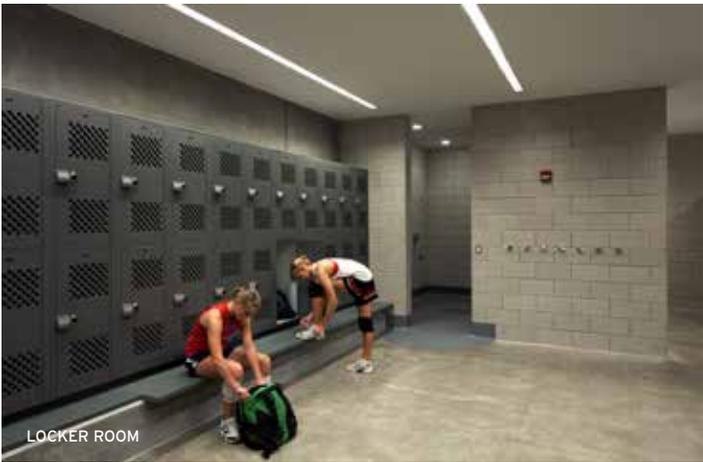




SCHOOL LOBBY



TYPICAL DAYLIT HALLWAY



LOCKER ROOM







## SUSTAINABLE DESIGN APPROACH/STRATEGIES

The design for the Greensburg School utilized an integrated approach to create a sustainable and restorative project that contributes significantly to the overall vitality of the community.

Some of the most important strategies address the health and well being of students and staff, which will facilitate and enhance learning while stimulating thought and creativity. The facility, which was designed to meet LEED Platinum standards, features efficient, durable and environmentally responsible resources. The building and site's integrated sustainable strategies and technology will reduce operating costs and add vitality to the grounds.

### **SUSTAINABLE SITE**

The site design for the school combines restoration of habitat with an infusion of native landscaping. A series of bio-swales, constructed wetlands, restored prairie and walking trails re-create natural environment areas that also process storm water. This environment reconnects students, staff and visitors with vital ecosystems while protecting the land from erosion. It also creates a natural habitat for native species.

These bio-filtration areas contain deep-rooted, native plants that improve the soil's ability to absorb and store water while they naturally filter storm water run-off.

The site and building design reduce the urban heat island effect on Greensburg through open area allocation and diverse landscaping. Native shade-providing trees

that can withstand local climate extremes and require less water also limit heat retention in the parking areas.

### **WATER EFFICIENCY**

Water is one of the most critically important resources on earth. With Greensburg's low annual rainfall average amounts, it becomes crucial to conserve and reuse whatever rainwater falls within the school boundaries. Increasing the efficiency of building water use safeguards water resources for the future as water becomes more costly and scarce.

By employing a variety of strategies, long-term water saving goals will be met while helping to reduce the burden on municipal waste water systems and reducing potable water demand. Many water efficiency strategies, such as providing low-flow plumbing fixtures, involve little or no additional cost.

As part of the design strategy to reduce potable water use, the building and site treats and reuses captured rainwater and gray water as much as possible for toilet flushing and irrigation needs. A constructed wetlands onsite treats wastewater, the buildings utilize efficient water-conserving equipment and appliances, and they capture condensation from HVAC equipment for reuse as make-up water in cooling towers.

#### **MATERIALS & RESOURCES**

The building and construction industry is changing rapidly as a result of consumer demand. New materials and methods of construction are introduced regularly as the industry strives to reduce the environmental impact of building while contributing to the creation of healthy environments for building occupants. One of the first priorities for material selection is to use fewer materials and use them efficiently. Durability is also a high priority to ensure that materials have a long life and are easy to maintain. Other important considerations include recycled content, regional manufacturing and low volatile organic compound (VOC) content.

To reduce the environmental impact of harvesting raw materials, products with recycled-content were used throughout the Greensburg School. These products utilize waste that would normally be placed in a landfill and that are reconstituted as

a valuable raw material. An example is the many fabrics and carpets now made from recycled plastic soda containers and milk jugs. Preferences were also given to materials that are manufactured within 500 miles of Greensburg. This helped to conserve transportation energy and lessened the environmental impact of transport while supporting local industry and communities.

The school utilizes materials that contribute to the creation of healthy environments. Paints, adhesives and carpets do not contain VOCs, which are compounds that vaporize into a gas at room temperature.

#### **ENVIRONMENTAL QUALITY**

Good indoor environmental quality (EQ) is a tangible and quantifiable measure of overall sustainable design, especially in a school environment. Good EQ increases the health and wellbeing of users. EQ encompasses all aspects of the built environment that impact the health and comfort of building occupants, such as indoor air quality (IAQ), controllability of systems, daylighting and views, acoustical control and ventilation.

The priorities for EQ are to choose materials and equipment that contribute to a healthy environment, isolate unavoidable sources of pollution, provide for adequate supply and filtering of fresh air and return air and maintain the building and its equipment in clean condition.

Indoor air quality can be adversely affected by a number of factors such as biological contaminants, particles and cigarette smoke as well as chemical pollutants that are off-gassed by materials like carpet, wall-coverings, paint and furniture.

Controllability of systems improves the psychological and physiological comfort levels of the interior environment. Associate control over the thermal and lighting conditions will promote productivity, comfort and well being. Individual controls and supplemental task lighting are examples of these strategies utilized in the Greensburg School.

Natural light is also a contributor to environmental quality; good lighting and window design for the school's interior spaces were achieved by using a series of daylighting models. The models help balance daylighting and views with sun control strategies to minimize unwanted heat gain and glare. Sun controls, such as sun shades and light shelves, were integrated into the building design to help maximize daylighting while minimizing unwanted heat gain and glare.

#### **ENERGY AND ATMOSPHERE**

100 percent of Greensburg School's electricity is from renewable energy sources. A 50 kilowatt wind turbine provides a portion of the project's electricity needs while the remaining power is generated at the wind farm located just outside of town. The wind



**PLANETREUSE & RECLAIMED MATERIALS** Estimates show that nearly 40 percent of landfill material comes from construction projects. To help mitigate this waste flow from the Greensburg School project, *PlanetReuse*, a reclaimed construction material broker and consultant company, worked with the design and construction team early in the design process to help incorporate reclaimed materials throughout the project, from interior wood furring and paneling reclaimed from deconstructed warehouses to exterior furring, siding and exterior bridges from knocked-down cypress salvaged from Hurricane Katrina. By being involved early, many material options were located, coordinated and shipped to the site when needed by the contractors for a savings to the project, all while diverting materials from the landfill.

turbine, located inside the southeast corner of the project's LEED boundary, is acoustically separated from the classrooms. This location also ensures the classrooms are outside of the turbine's fall zone.

HVAC (Geo-thermal closed loop ground source heat pump) systems were designed to isolate unavoidable sources of pollution, provide for adequate supply and filtering of fresh air and return air and maintain the building and its equipment in clean condition. Controllability of systems improved the psychological and physiological comfort levels of the interior environment promoting productivity and well being. Individual controls and supplemental task lighting are examples of the strategies implemented.

Continuous monitoring equipment tracks performance of the building systems and equipment enabling enhanced commissioning of the systems to ensure proper performance throughout the life of the building.

The building envelope, orientation, lighting and sun control systems for the school buildings were designed to minimize the heating and air-conditioning loads for the building. This, in conjunction with high efficiency chillers and modular air-handlers, will result in substantial savings over an ASHRAE 90.1, 2004 baseline building.

“BNIM designed a high-performance facility that embraces the spirit of the community and sets a new standard for sustainable design in a K-12 educational facility. The school will be a source of pride in our community for decades to come.”

DAWRIN HEADRICK, GREENSBURG USD 422 SUPERINTENDENT





HIGH SCHOOL HALLWAY AND MEZZANINE

## BNIM LEARNING/PEDAGOGICAL PROJECTS

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1 Fort Osage Education Center 2 JJ Pickle Elementary School 3 Kasson-Mantorville High School Design Competition 4 5 6 Anita B. Gorman Conservation Discovery Center 7 Odum School of Ecology 8 Blue Valley Schools 9 Earthworks 10 Science City at Union Station 11 12 Omega Center for Sustainable Living 13 14 15 Ford Learning Center At The Nelson-Atkins Museum Of Art 16 Fayez S. Sarofim Research Building 17 Christopher S. Bond Life Sciences Center 18 School of Nursing and Student Community Center

## BNIM is a leading design firm working to redefine practice in the realm of green architecture today.

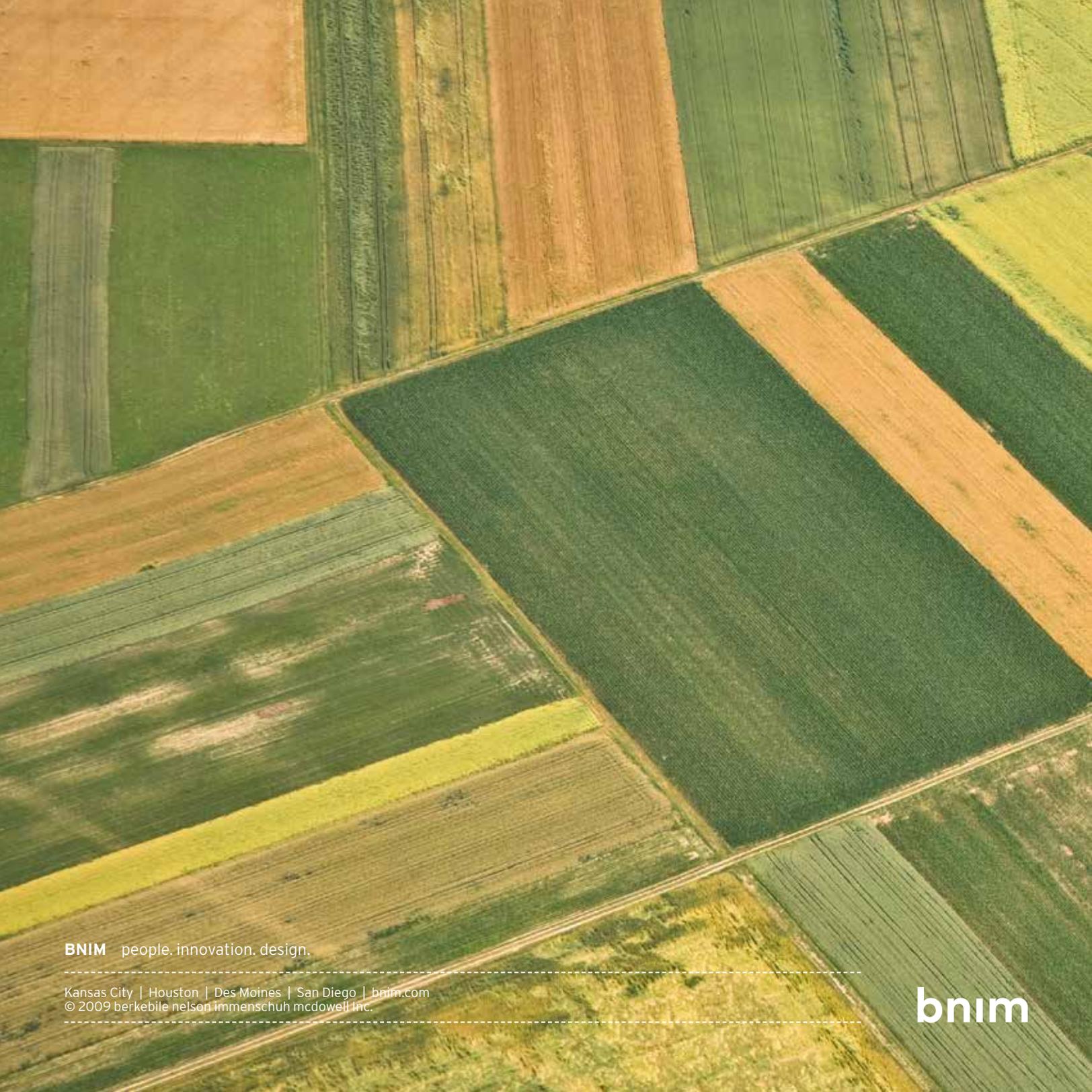
As early pioneers in the arena of sustainable design, BNIM continues to shape the national and global agenda for responsible architecture and design excellence. Established in 1970, the firm has emerged nationally as a leading resource for established methodologies, innovative technologies and cutting-edge research in architecture, planning, landscape and workplace design. Their process is deeply rooted in the concept of integration, where clients and collaborators work together to create buildings and spaces that embrace the *Triple Bottom Line*—a balance of people, planet and prosperity. Their body of work maps the evolution of sustainable design process and thinking: from early pilot projects that defined the USGBC's LEED rating system, to the first LEED Platinum project, to current work that goes beyond LEED's highest standards to achieve Living Building status.



OMEGA CENTER FOR SUSTAINABLE LIVING  
2010 COTE TOP 10 GREEN PROJECT







**BNIM** people. innovation. design.

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**bnim**