

# Design

## Environmental Design

### Introducing Roland Wiley

Roland Wiley is an architect in Los Angeles, building schools that raise consciousness about environmental principles by integrating sound, green technologies and concepts into his work. He explains that it goes way beyond saving water or saving trees. Architects are now thinking about using a carpet with sustainable fibers, choosing materials for the concrete they use, and selecting steel based on its origination and considering how far it will have to be transported. Architects are examining the chemical composition of walls, paints, and furnishings for potential off-gassing issues.

Programs such as the *Collaborative for High Performance Schools* (CHPS) and the *Leadership in Energy and Environmental Design* (LEED) certification provide guidelines that schools and districts can follow towards implementing the environmental principles in which they believe.

When a district builds a new school, site planning is the most important step and it guides all the decisions that follow.



The architect takes advantage of the natural features of the site, including the sun's orientation for natural lighting and heat; the prevailing wind for cooling and air flow; the slope of the land for water flow, drainage, and water collection; and trees for shade and the enhanced beauty they provide. Site planning includes looking at transportation: how students will get to the school and whether the location of the campus helps build a quality community or not.

Once the site is selected, the architect must consider whether any existing buildings can be retrofitted to the new purpose. He or she must calculate the cost and energy expended in demolition, and how materials can be reused or otherwise diverted from landfills and plan the new materials to be purchased, considering whether they are indigenous and how far they will be transported. Architects must consider the impact of the volume and orientation of the building on the energy costs for heating and cooling.

"We are absolutely making progress," says Wiley. "We are raising awareness, implementing new ideas, and including environmental consciousness into our licensing and training." Now he urges schools to use their green buildings to teach about solar orientation, water resources, sustainable technologies, and the importance of maintaining balance in our ecosystems.

***What should be considered when planning the site for a school?***

***Why may it be better to retrofit an existing building than to build a new one?***

***How can the selection of building materials impact the cost and health of a new building?***

## Where Should I Build My School?

### Purpose:

In the real world, making decisions is often more about compromising than finding the *perfect* solution. Reading maps requires students to take in a variety of information and understand the implications of what they are looking at. This difficult work requires practice.

### Focus Concepts:

1. Maps represent a specific location and provide useful information that can be used for making decisions.
2. There are different purposes for making maps.
3. The information selected for a map is related to its intended use.

### 21st Century Skills:

Digital age literacy: basic, technological, visual, information and cultural literacy

Inventive thinking: self-direction, creativity, sound reasoning

Quality: planning, effective use of real-world tools, results with real-world application

### Environmental Principles:

**Principle II:** The long-term functioning and health of terrestrial, freshwater, coastal, and marine ecosystems are influenced by their relationships with human societies. As a basis for understanding this principle:

**Concept C.** Students need to know that the expansion and operation of human communities influences the geographic extent, composition, biological diversity, and viability of natural systems.

**Principle V:** Decisions affecting resources and natural systems are based on a wide range of considerations and decision-making processes. As a basis for understanding this principle:

**Concept A.** Students need to know the spectrum of what is considered in making decisions about resources and natural systems, and how those factors influence decisions.

### Vocabulary:

- design
- environment
- legend

## Lesson: Building a New School

Students will determine the best placement for a new school based on a variety of criteria.

### Materials:

- colored pencils
- map of local community (optional)

### Safety Notes:

If using the terrarium, students should wash their hands after touching organic materials.

### Procedures:

1. Give students the handout, "Grand Community Map," and review basic map-reading skills (symbols, orientation, giving directions from one location to another, etc.).
2. Direct students to plots A, B, and C. Discuss each plot with students (for example, discuss what natural and man-made features are near each one).
3. Students form groups to discuss which site would best for building a new school.
4. Students share their discussions and come to consensus.  
*Note:* Each plot has some positive and negative features, so encourage students to weigh the pros and cons of each site.
5. Take students on a walk of your neighborhood or examine pictures. Have them create a map of their community. (To shorten the lesson, give students a map of your community.)
6. In groups, have students determine the best location for building a new school. Student groups should present their arguments persuasively, reflecting the pros and cons of their chosen sites.



To make the exercise easier, students can elect to demolish existing buildings (eminent domain) in order to acquire the “optimal” plot for their school.

**Discussion Starters:**

1. What should be considered when selecting a location for a school?
2. How do the symbols on a map help you understand the information presented?



What would you do if you were given the opportunity of a lifetime – to build a new school in your community?  
Where would you put it?

School districts and architects work together to determine the best place to build new school facilities. There are many things they think about when planning the location of a building:

- **Natural light** – The sun’s light can warm buildings on a cold day, and shade from trees or mountains can keep them cool. Windows can provide warm light and a vista to look upon.
- **Noise** – Sounds from airports, trains, busy streets, and industrial activity can be distracting and can make it difficult to communicate in the classroom.
- **Access** – Neighborhood schools should be easy to get to, with safe pathways between the school and students’ homes. Nearby businesses should be appropriate to the age of the students, and open spaces should be considered for potential school-outreach activities.
- **Water flow** – Natural streams and places where water pools when it rains can have a significant positive or negative impact on a school site.
- **Wildlife** – Proximity to migration paths, nesting areas, and breeding zones for pests (mosquitoes and wasps) can impact the school environment.







## Which School?

### Purpose:

There are many factors involved in designing a school. Students should bring their knowledge of geology, environmental conditions, and selection of building materials together to identify the optimal school building plan.

### Focus Concepts:

1. Negative natural conditions cannot always be avoided, but they can be mitigated.
2. The ecosystem can interact with students or the school building as a positive or negative influence.
3. The design of a school building, including the choice of building materials, can play a significant role in the success of the school plan.

### 21st Century Skills:

Digital age literacy: visual and information literacy

Inventive thinking: managing complexity, risk-taking, higher-order thinking

Interactive communication: collaboration

Quality: high-quality results with real-world application

### Environmental Principles:

**Principle V:** Decisions affecting resources and natural systems are based on a wide range of considerations and decision-making processes. As a basis for understanding this principle:

**Concept A.** Students need to know the spectrum of what is considered in making decisions about resources and natural systems, and how those factors influence decisions.

### Vocabulary:

- impact
- hazard
- mitigation
- toxin

## Lesson: Which School is Appropriate?

Students analyze a series of scenarios to select the school that is most appropriate for a setting.

### Materials:

- set of scenario cards

### Procedures:

1. On the board, list three headings: geology, environmental impact, and building choices.
2. Ask students to brainstorm potential hazards and record them on the board under the appropriate heading.
3. Present each scenario card to the students. Guide the discussion so students understand the potential hazards or toxins of each scenario, and what could be changed in the building design to make it more appropriate to its setting.
4. Students form teams, and each team is given a setting on which to build a school. Each team designs its “perfect school” and presents this design to the class for review.
5. Possible extension: Students analyze local schools for their responsiveness to the natural world around them.



**Notes for the Teacher:**

Below is a list of the impacts that students should recognize from each scenario card:

- **School A:** Mobile-style buildings are considered unsafe in hurricane zones. Schools should be easily accessible to emergency vehicles. Easy access to clean water should be available. It is unclear whether or not this is the case.
- **School B:** Schools situated on earthquake faults typically are not made of brick. The bird migration may result in added sanitation costs. Tests showing high levels of radon should prompt mitigating processes, such as maintaining air flow in the classroom by keeping windows open.
- **School C:** Since this school is situated in a flood zone, it makes sense that the school has more than one floor and that staff practice procedures in case the reservoir dam should fail. Traffic management assists in drop-off and pick-up procedures.
- **School D:** A school built for an environment that gets snow should be compact and therefore is often more than one floor to centralize heating. The proximity to a nature preserve can offer great opportunities for students to learn from the setting, but students with allergies can have trouble in the spring. Flooding followed by still water can result in mosquito blooms.
- **School E:** Schools located in flood-prone areas should be more than one floor in height. Given the likelihood of tornadoes, the school should have a cellar, basement, or other facility in case little warning is available. Given the potential for natural disasters, multiple pathways to and from the school should be available.

**Discussion Starters:**

1. Why are the guidelines for building schools regional?
2. Which environmental impacts affect the safety of students and staff?
3. How does the natural environment affect the students' ability to learn in the classroom?



*School A* is a temporary building, placed on a foundation, similar to a mobile home. The school is located near the Gulf of Mexico. It is located on a dirt road that when wet, often requires off-road wheels to navigate. This remote location provides quiet concentration for students, but since it is not on the city water lines, it must use a local well and septic systems.



*School B* is located on a series of active earthquake faults and along a coastal bird-migration path. The soil has been tested and shows high levels of radon. The on- and off-shore breezes help maintain a constant and comfortable temperature in the classrooms. By afternoon on most days, it is sunny.



*School C* is located just below the reservoir and dam for the community. One-way streets were just posted to assist with traffic flow in the early mornings and afternoons. Annual drills on what to do during flooding are performed.



*School D* is located in high altitude and winter snows are beautiful against the brick building façade. There is a nature preserve behind the campus, and wildflowers bloom abundantly in the spring. The stream that runs through the preserve floods annually, depositing rich nutrients that are used for the school's organic garden.



*School E* is located in a cul-du-sac along a shallow tributary to a major river in the Midwest. This design has no cellar or basement.

