

MODULAR MONTESSORI

EDUCATING TOWARDS ECOLOGICAL SUSTAINABILITY

DESIGN THESIS BY TOMMY SCHMIDT



QUESTION

How can **modular architecture** help promote **ecological sustainability** in a **traditional public school environment**?

ECOLOGY

Relationship of organisms to one another and to their physical environment.

SUSTAINABILITY

Promotes equality between people of today and people of tomorrow. Creates balance between our ecological, social, and economic needs.

ECOLOGICAL SUSTAINABILITY

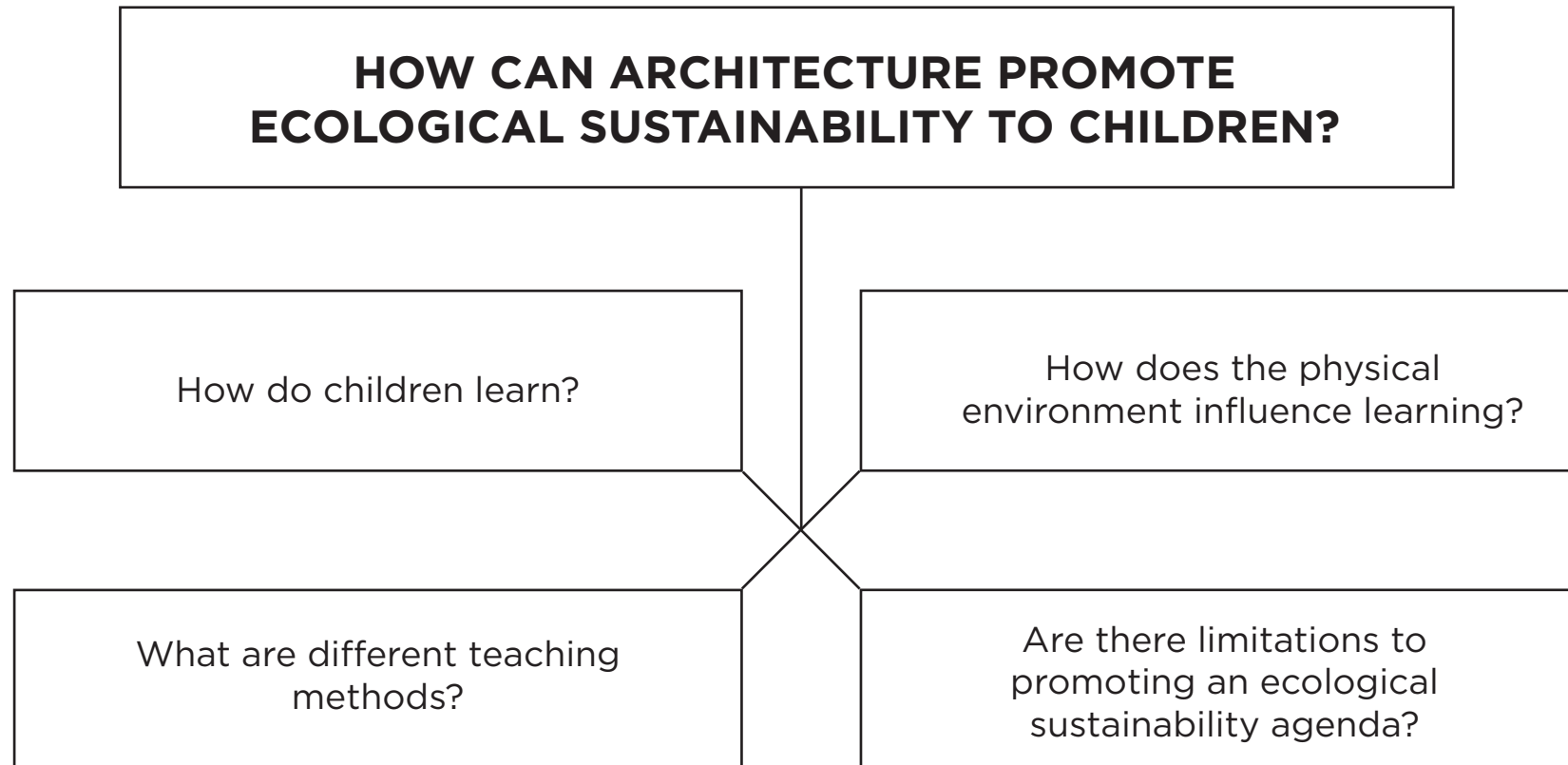
The promotion of equality amongst our people and their relationships with each other and their environment



RESEARCH: INTERPRETIVE

RESEARCH & FINDINGS

SYSTEM OF INQUIRY	EMANCIPATORY		
STRATEGIES	INTERPRETIVE	QUALITATIVE	LOGICAL ARGUMENT
TACTICS	LITERATURE REVIEW PERSONAL INTERVIEWS	LITERATURE REVIEW PERSONAL INTERVIEWS	LOGICAL ITERATIONS



Montessori Method of Teaching

- Developed in 1897 by Maria Montessori in Italy
- Promotes student choice and learning independently
- Mixed age classrooms
- “Prepared Environment” built to encourage discovery and learning

Source: *American Montessori Society*



MONTESSORI METHOD FINDINGS

DAKOTA MONTESSORI SCHOOL

CHILD DEVELOPMENT

NATURE

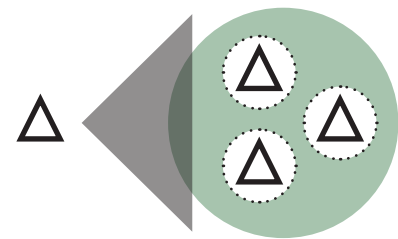
BUILT ENVIRONMENT



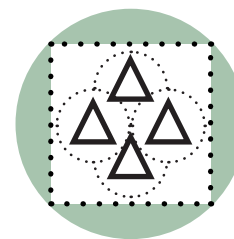
Learning in Zones

In school, the notion of learning revolves around a classroom and the teaching that takes place within its walls. Montessori classrooms take a more dynamic approach to layout with multiple zones of different activity and different learning styles. Traditional public school classrooms are largely the same layout with a series of desks faced toward a central element, such as a white board or the teacher at the front. However, research shows that learning is a complicated and varied operation that requires engagement in many different ways.

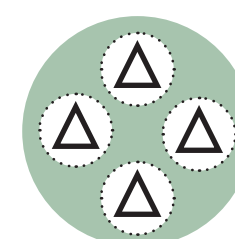
According to Peter Lippmann, learning and knowledge acquisition occurs in two basic ways: active and passive. Active learning requires direct engagement in an activity. Direct participation in an activity reinforces ideas and concepts and forms meaning with the individual. Passive learning can be considered the traditional way of teaching, which would involve a teacher facilitating learning by lecturing in a large group format. Lippmann argues for the active learning approach, which shows that children learn best in a variety of different ways and in direct engagement.



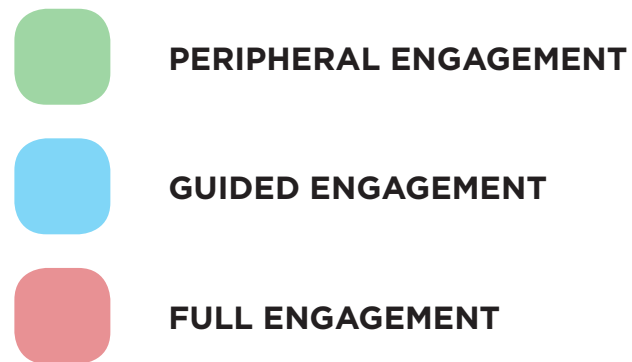
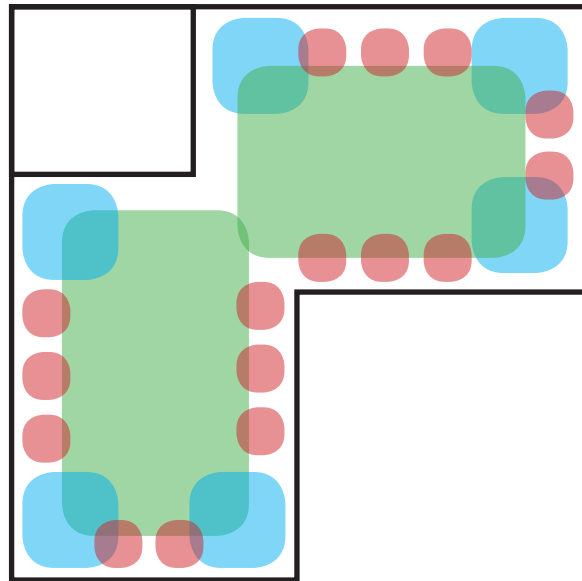
PERIPHERAL ENGAGEMENT



GUIDED ENGAGEMENT



FULL ENGAGEMENT

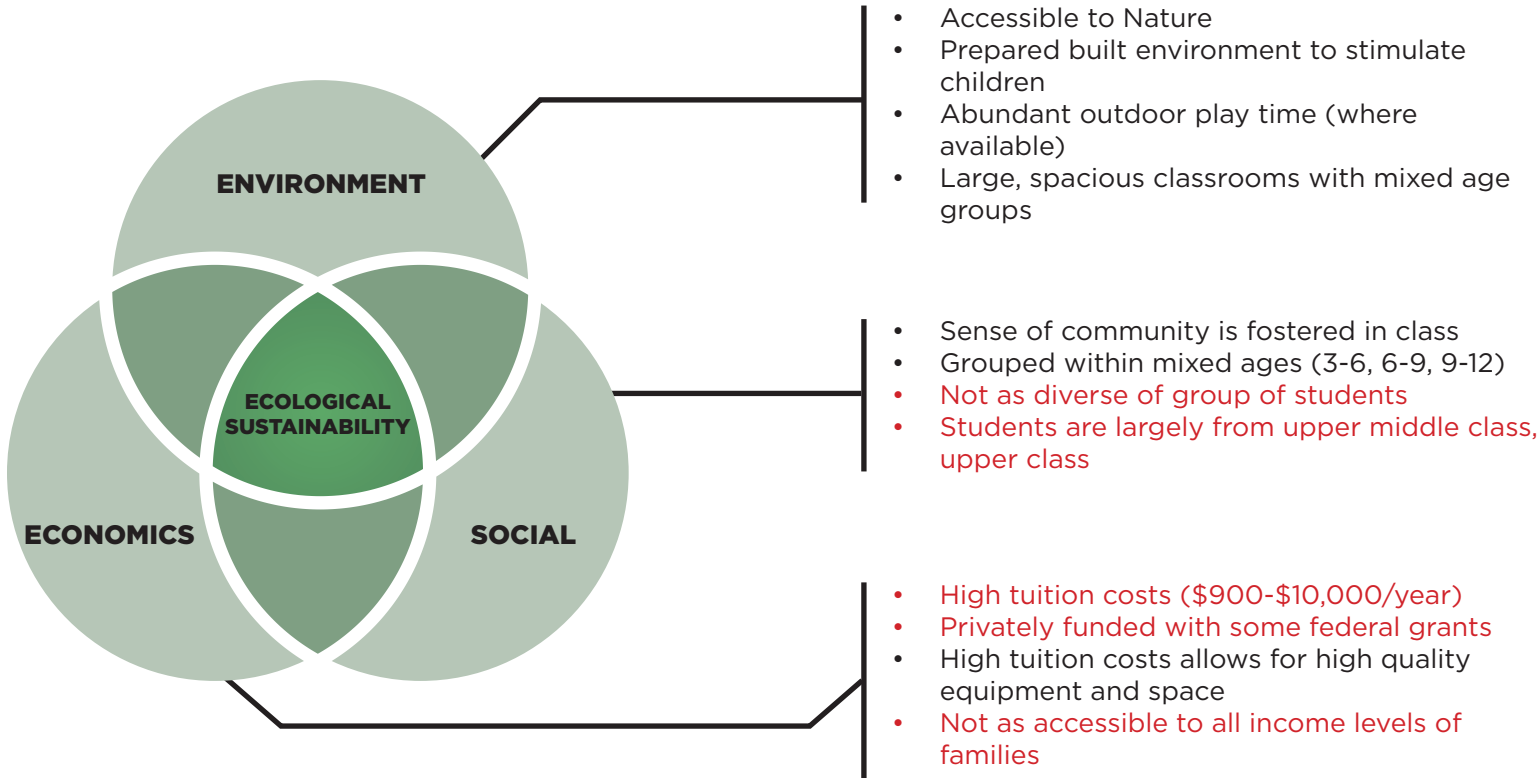


“L” Shaped Classrooms

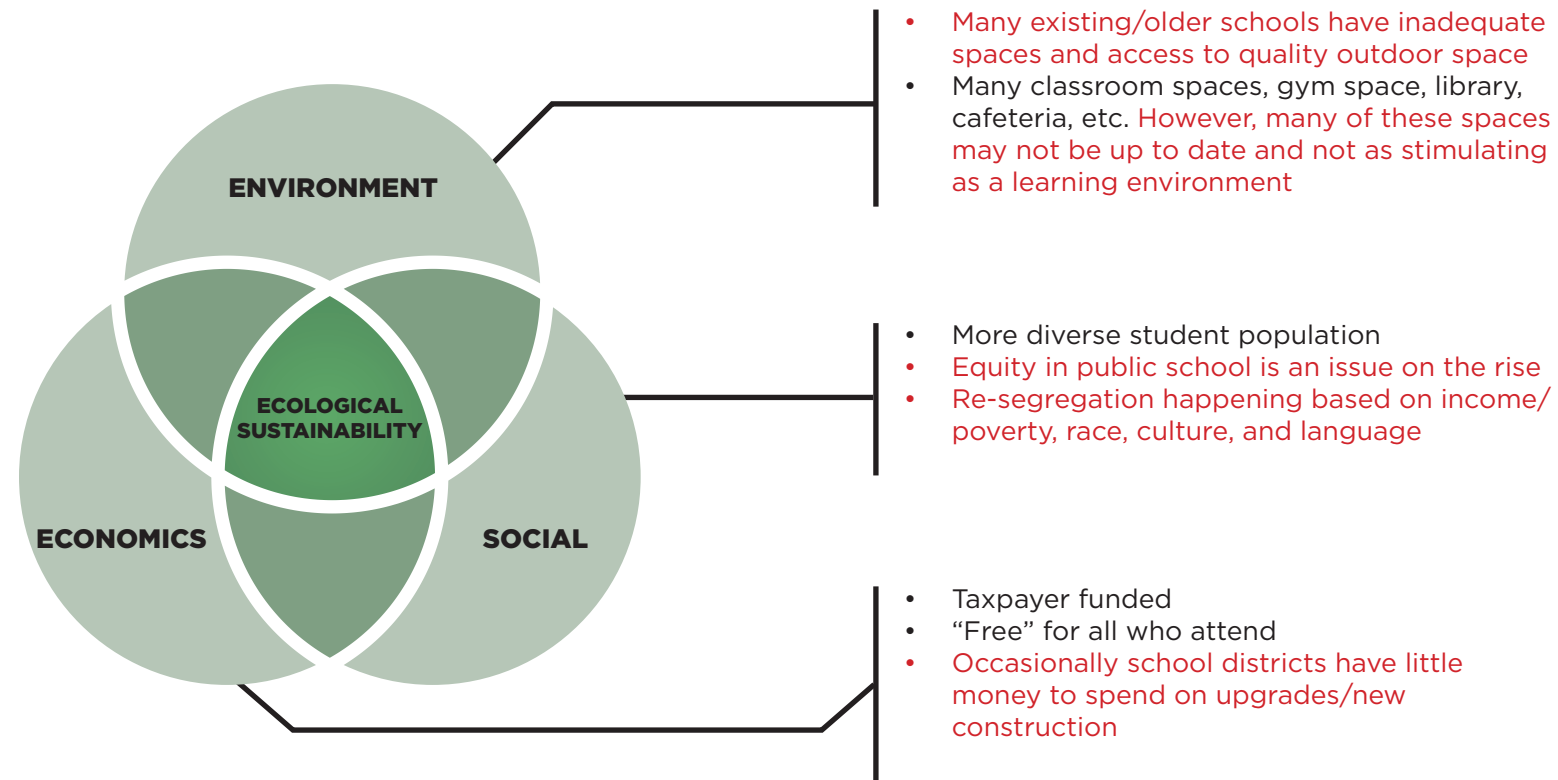
Guidelines, according to James Dyck, for the L shaped classroom include:

- It has to accommodate the formation and functioning of small learning groups while providing a sense of separation, because groups working together will experience distractions and non productive interaction
- It has to be flexible enough to allow the continual reorganization of the whole class into large and small learning groups. This means that the space must be as free as possible from permanent obstructions
- It has to be manageable by a single teacher who has command of the entire space. This means it must be compact and open. (Dyck, 1994, p. 44)

MONTESSORI METHOD



TRADITIONAL PUBLIC SCHOOL





MICRO EXAMPLES

ENVIRONMENT

- Indoor air quality standards increase resulting in healthier children
- Learning environment designed to encourage learning rather than encourage distraction

SOCIAL

- School designed to encourage collaboration focused around a project based curriculum

ECONOMICS

- Providing opportunity for lower income students learn in a state of the art facility

MACRO EXAMPLES

ENVIRONMENT

- Positive learning environments focused towards nature and learning

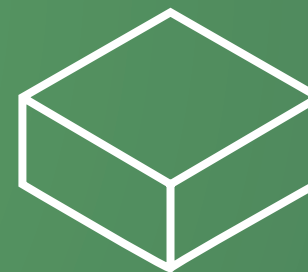
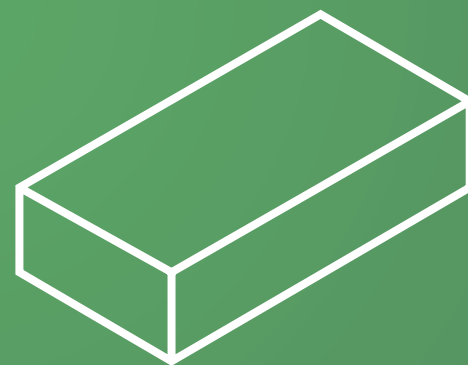
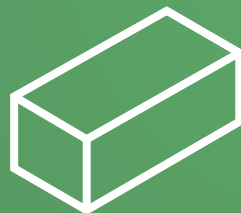
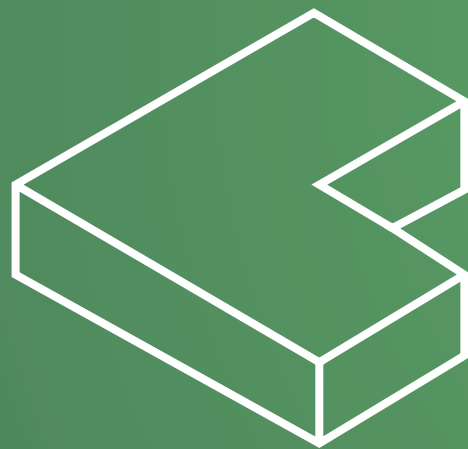
SOCIAL


- Children with fewer behavioral issues at school
- Diverse student body from many backgrounds

ECONOMICS

- School districts saving money on sustainable building practices over time

KIT OF PARTS

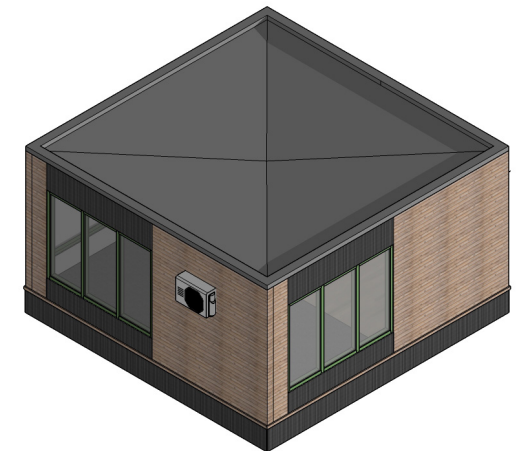
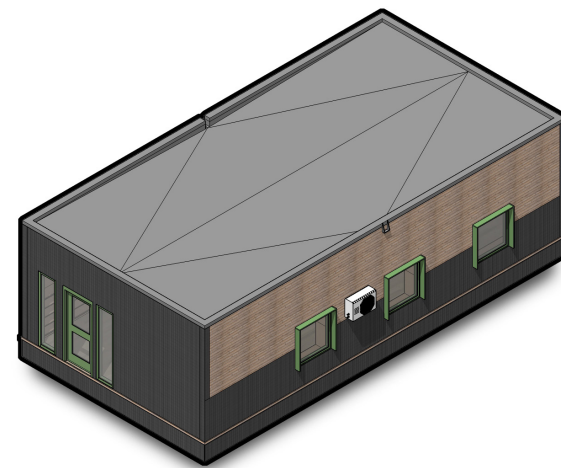
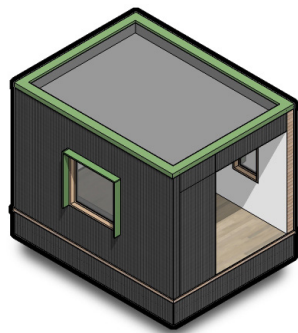
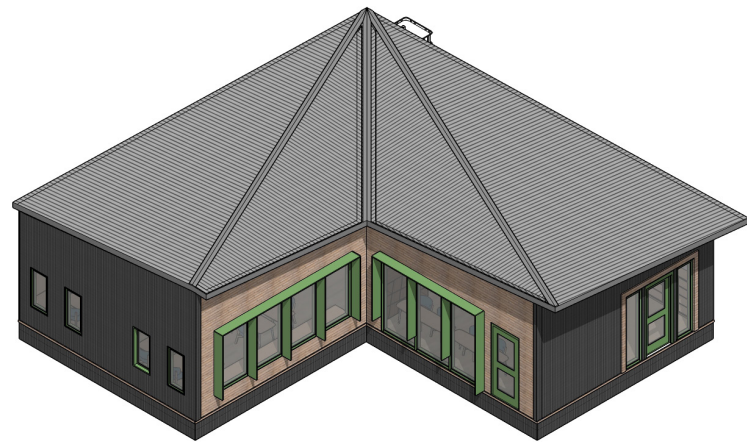




In many places around the country, children are not learning in the most ideal environment. Schools built decades ago were built for affordability and constructibility (Lippmann), not for a child to develop and thrive. Some of these schools are now dealing with over crowding a lack of quality space to house their classrooms. One of the cheapest and fastest solutions is acquiring portable classrooms. These spaces are considered temporary solutions, yet often become permanent fixtures on the school yard. The portables are built as temporary, and thus are not suited for the learner but rather the convenience of alleviating a problem.

KIT OF PARTS

These modular and portable classrooms and units will create a learning environment that promotes socially conscious learning techniques, enhanced emphasis on a connection to nature, and be affordable and flexible for public schools around the country. The Kit of Parts will consist of a classroom, flexible space, node, and corridors to connect them all together. Each piece has been carefully designed and programmed based off of achieving the goals of ecological sustainability and each has been influenced by the Montessori approach to learning and teaching.

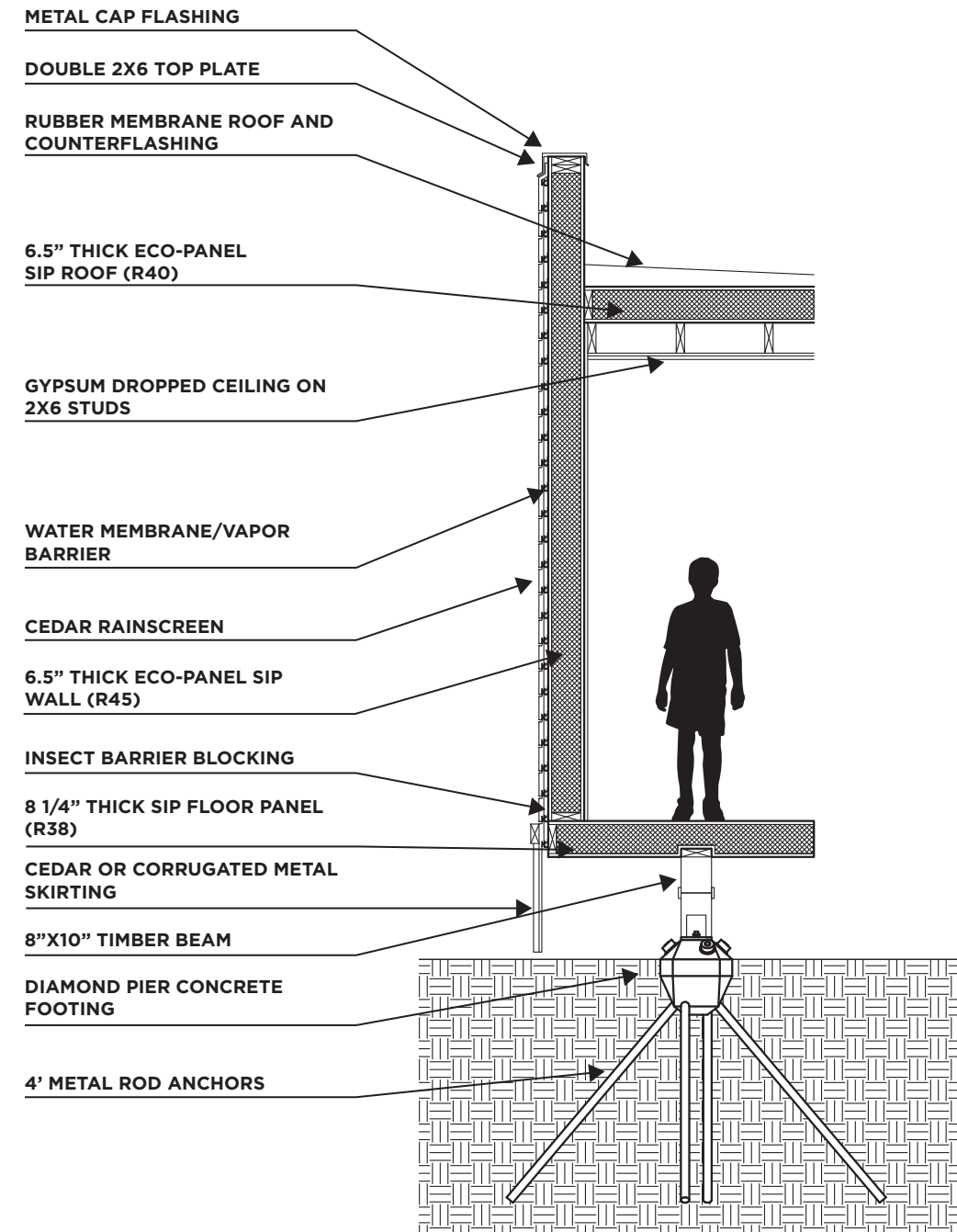


TYPICAL CONSTRUCTION

The construction of each part of the kit is carefully crafted to ensure a comfortable and stimulating environment both inside and outside the structures. Structurally Insulated Panels (SIPs) are utilized for modularity and sustainability, and special Diamond Piers act as the foundation, which is a cheap option and requires minimal excavation of the sites.

SUSTAINABLE BUILDING TECHNIQUES

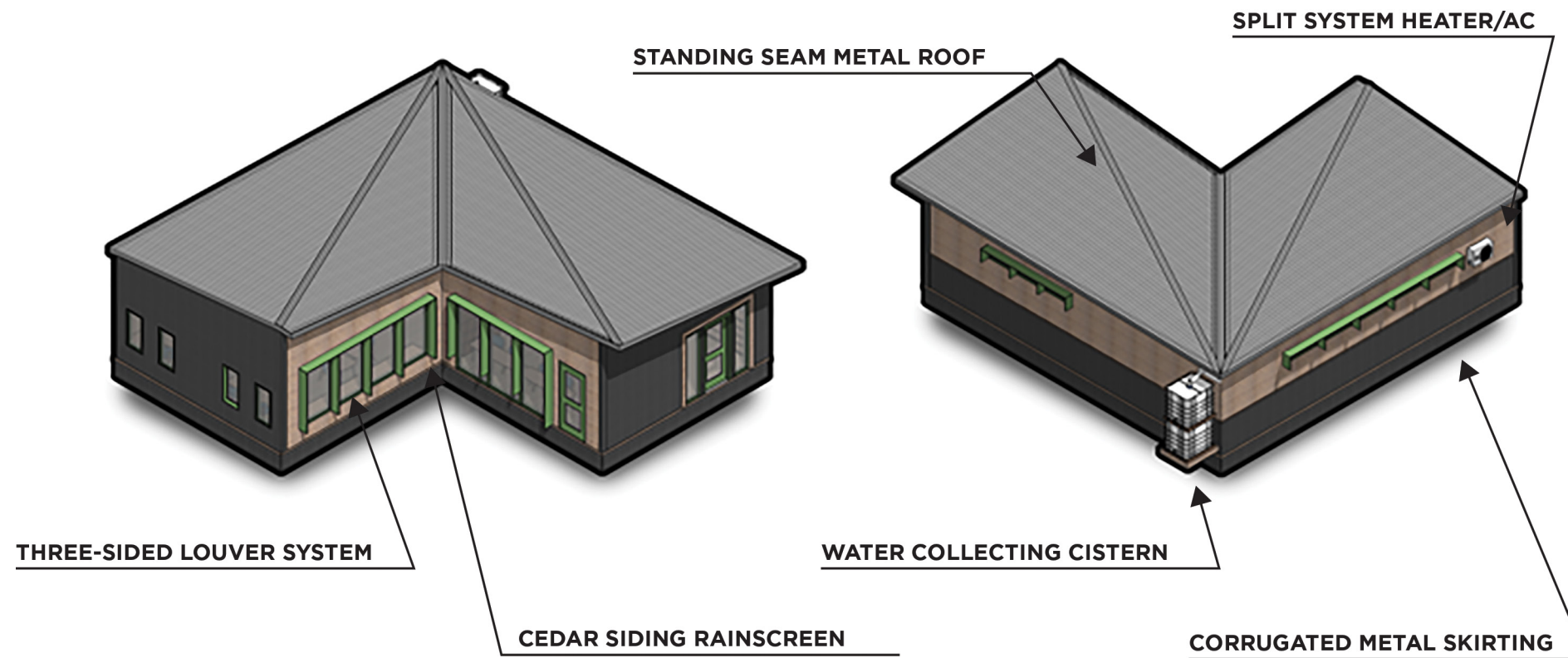
- Polystyrene Structurally Insulated Panels
- Diamond Pier Footing and Foundation System
- Non VOC finishes
- Portable, modular construction
- High efficiency split system heater/AC
- Low-E windows
- Water harvesting, gray water recycling
- Future proofed for Solar Panels
- Recyclable Corrugated Metal Siding
- Cedar Siding
- LED lighting





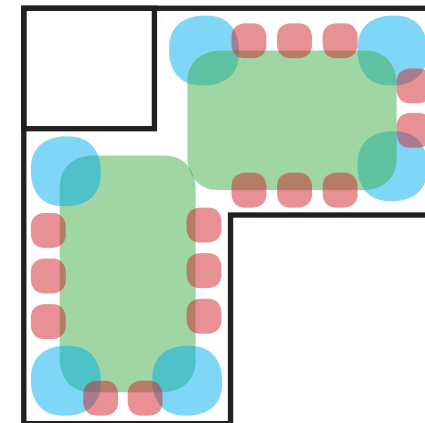
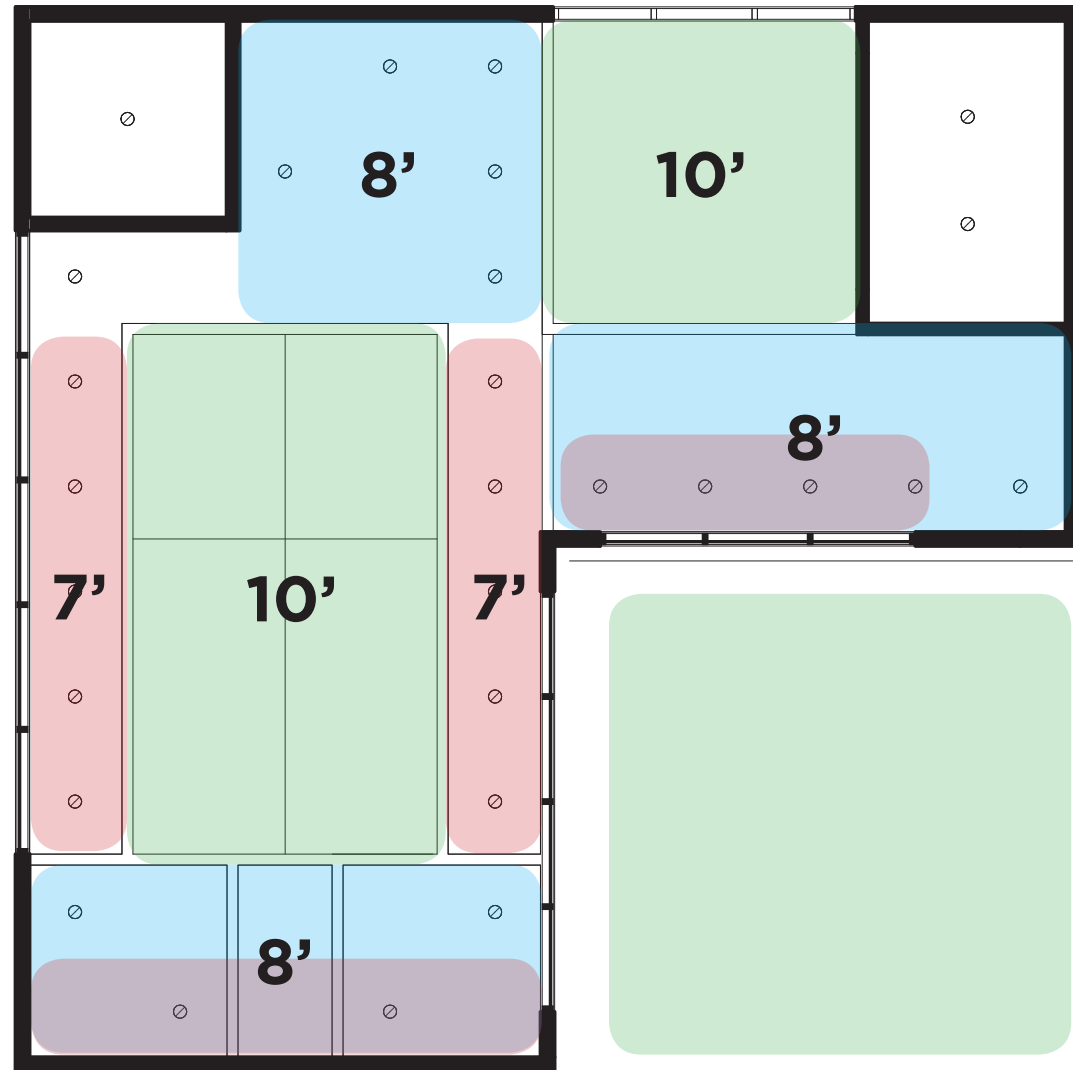
RESEARCH: LOGICAL ITERATIONS

CLASSROOM





KIT OF PARTS: CLASSROOM



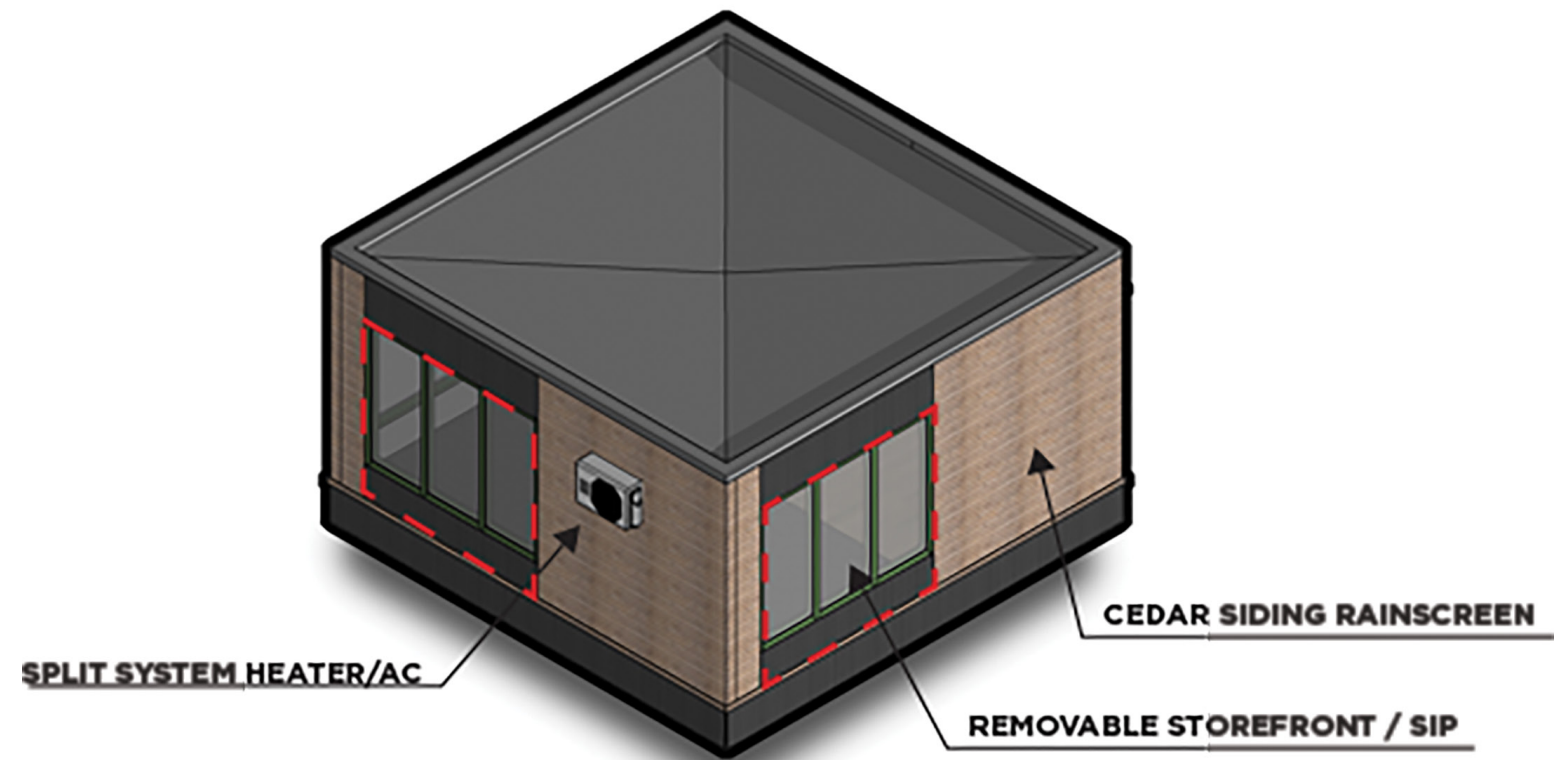
- PERIPHERAL ENGAGEMENT
- GUIDED ENGAGEMENT
- FULL ENGAGEMENT

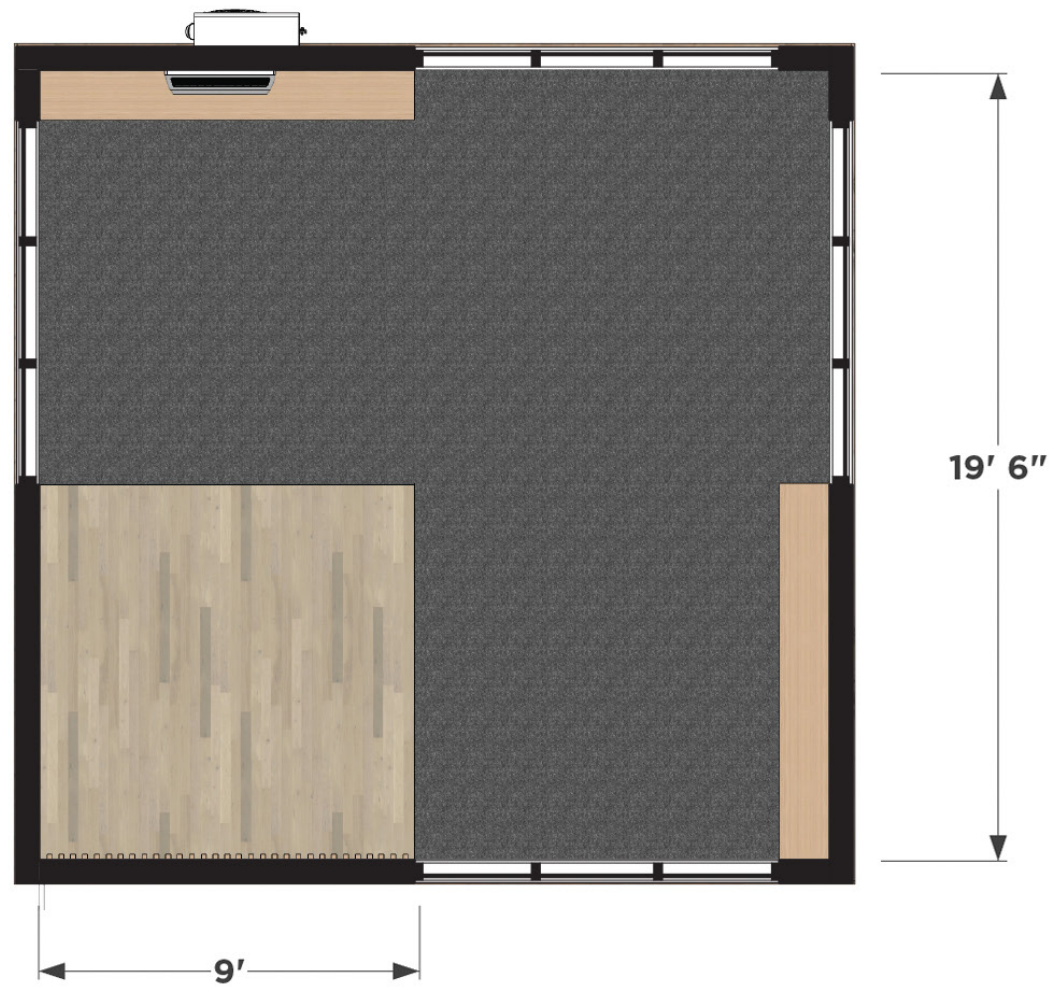


KIT OF PARTS: CLASSROOM

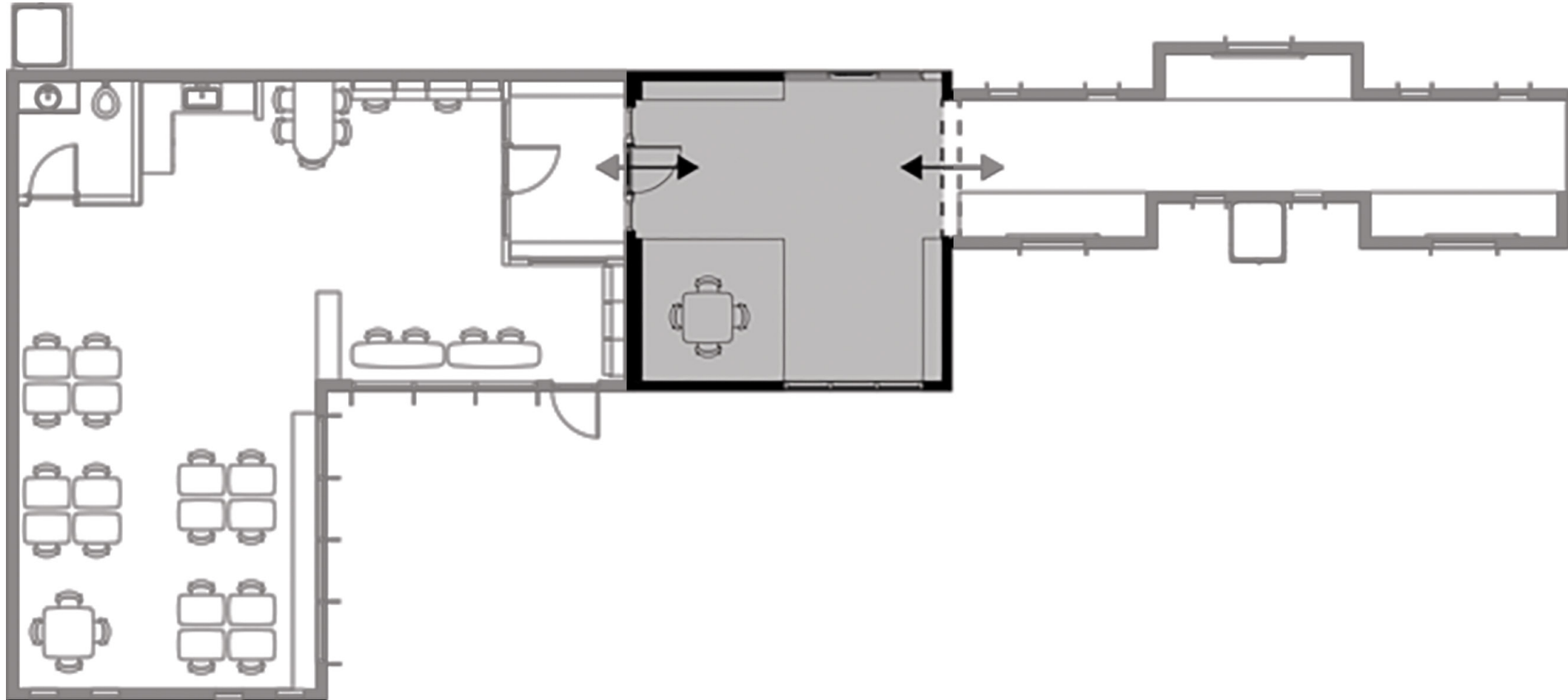
NODE

The Node piece acts both as a connecting piece and an additional learning space. Creating dynamic learning spaces that fit the needs of all students and their different learning styles is key to creating a more sustainable learning environment for everyone. The Node forms an implied “L” shape that creates a defined learning area for groups to gather. This space is defined by a change in flooring material and an engaging wall and ceiling feature that encourages gathering.





KIT OF PARTS: NODE



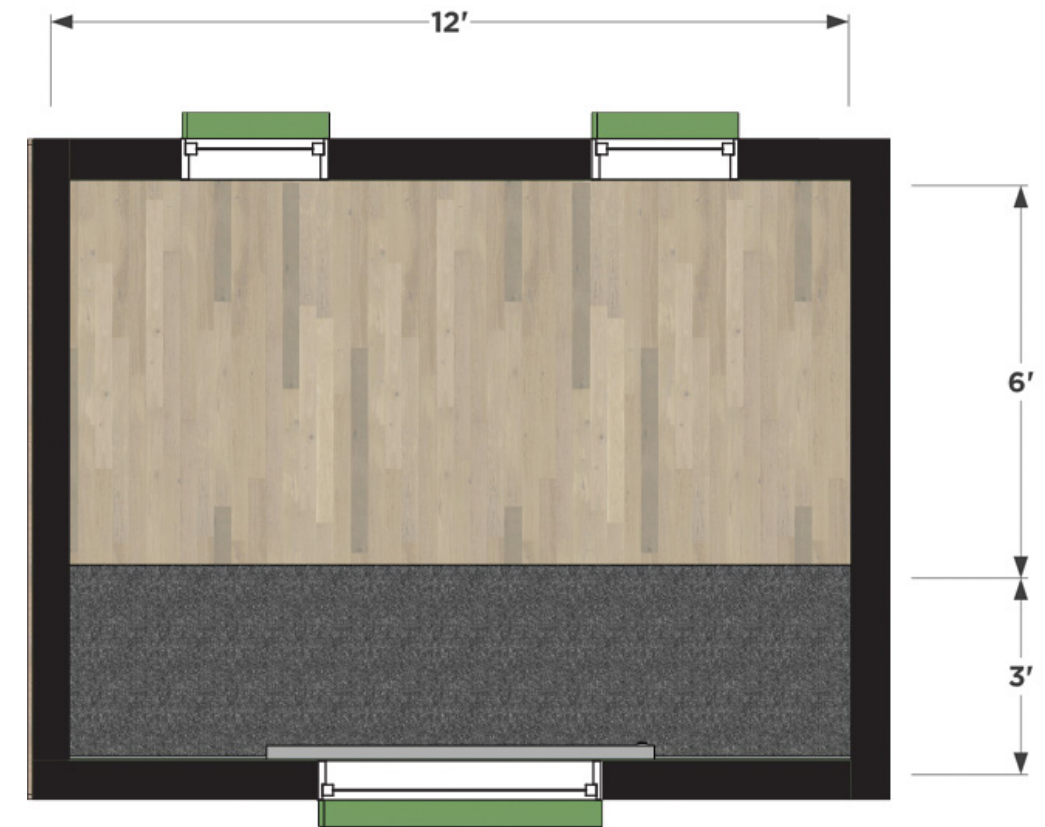
KIT OF PARTS: NODE



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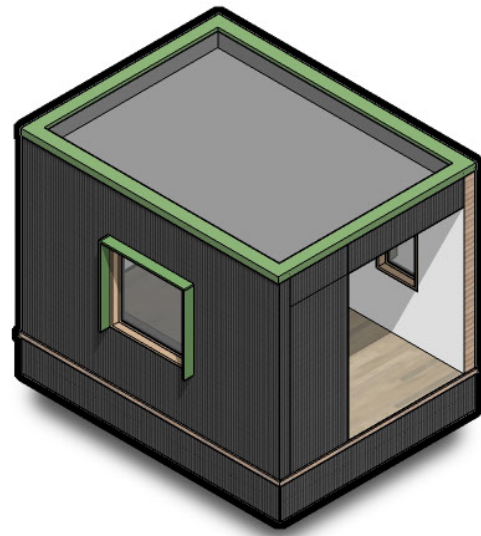
CORRIDOR

Learning spaces do not have to be exclusive to the classroom. It can take place throughout the entire facility. With corridors and other breakout areas being fully integrated into a learner centric view, the chance for knowledge acquisition and learning strengthens. School corridors have, essentially, been an area of transition. However, what if it were considered a functional area of learning? If students are to acquire practical skills, the organization of both corridors and classroom spaces need to be reevaluated as layered environments that promote individual, one to one, and small group/large group transactions (Lippmann, 2007a, 2007b, 2007c).

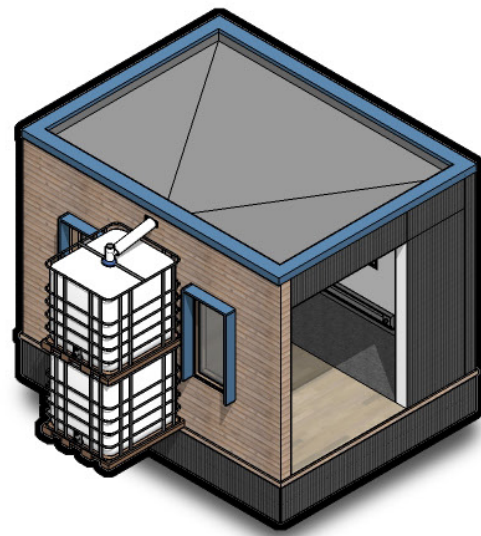


CORRIDOR VARIATIONS

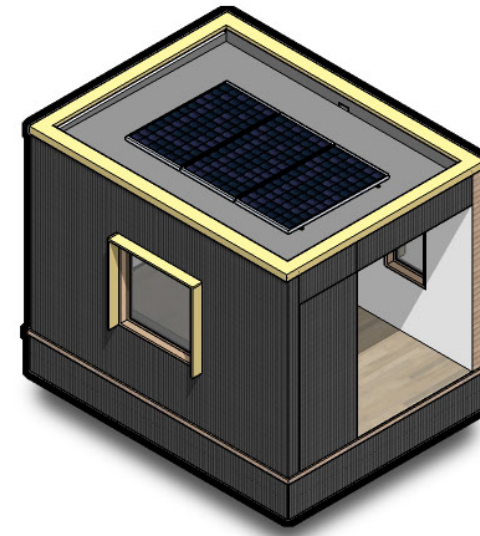
Each type of corridor piece offers a unique function. The 'Solar' corridor is equipped with solar panels on the roof, the 'Hydro' corridor features the water harvesting system used in the classrooms, and the 'Accessible' corridor features the required ramp slope for ADA in the case of elevation change within the sites.



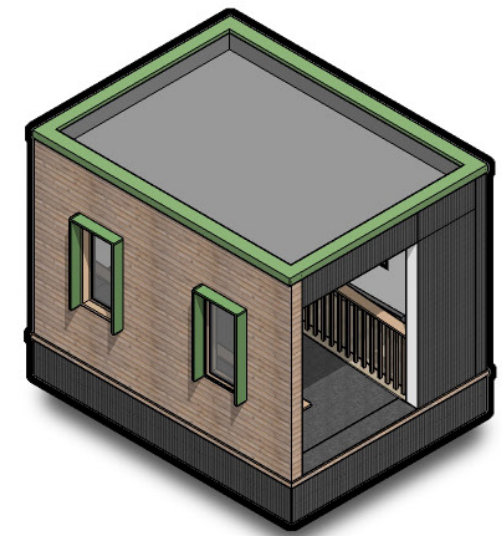
GENERAL



HYDRO

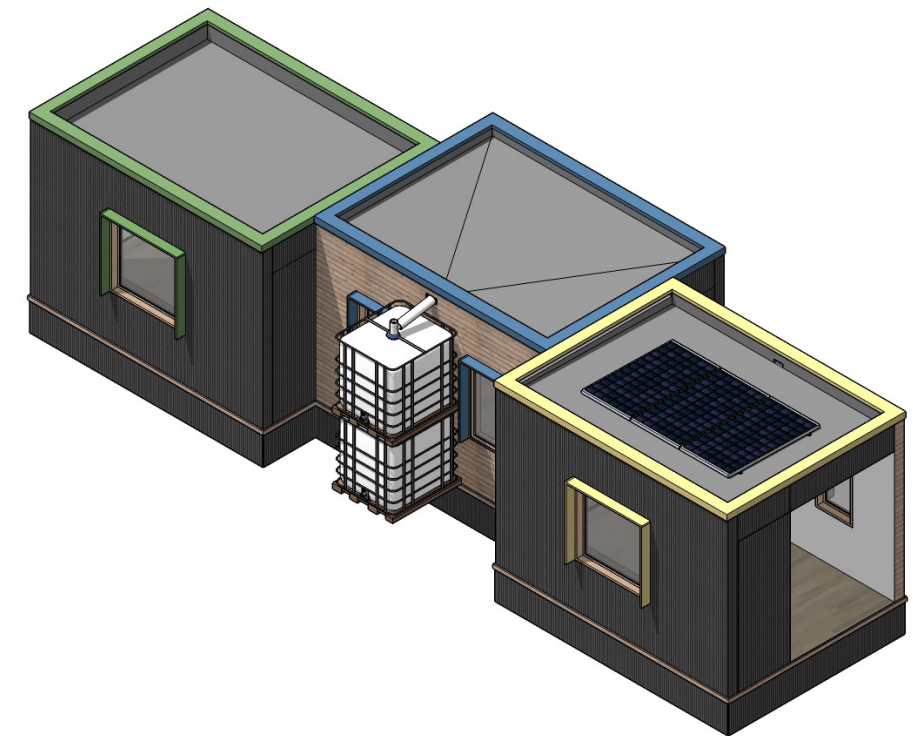
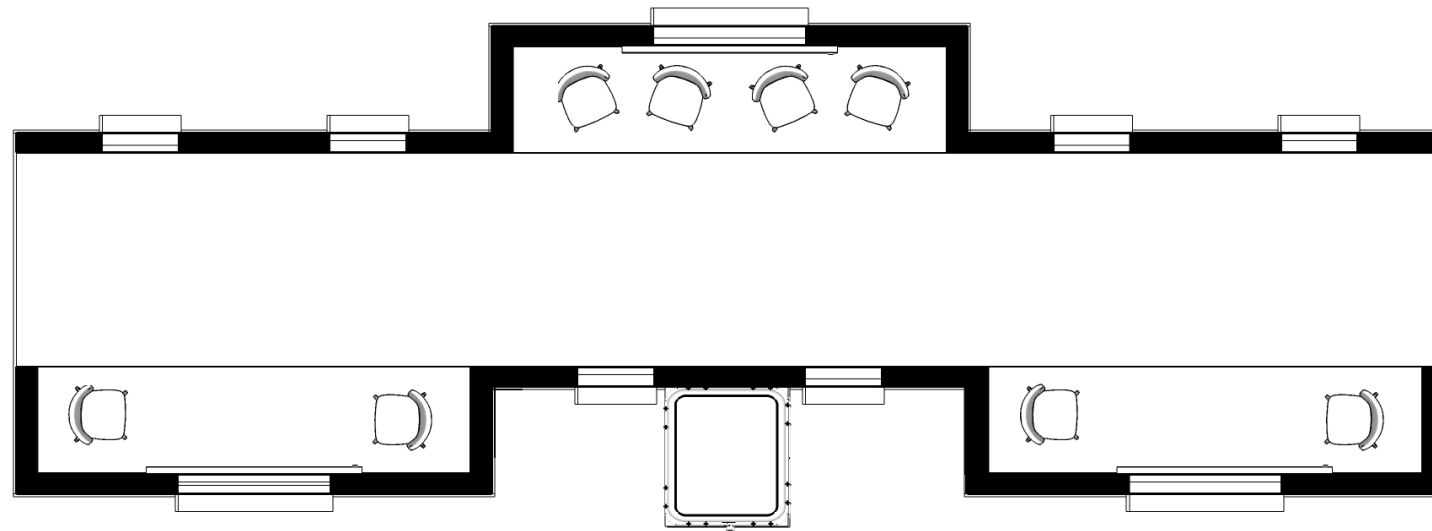


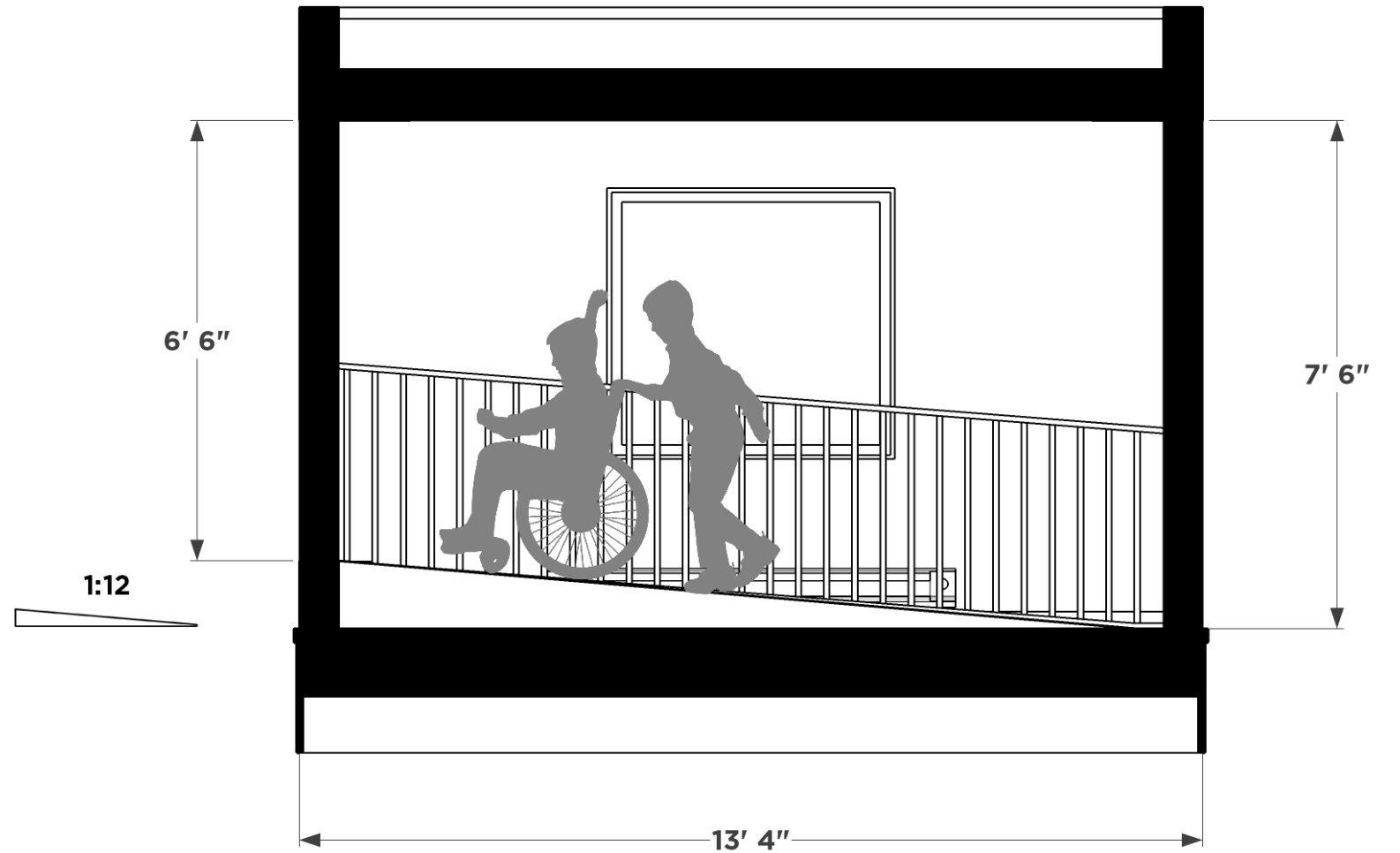
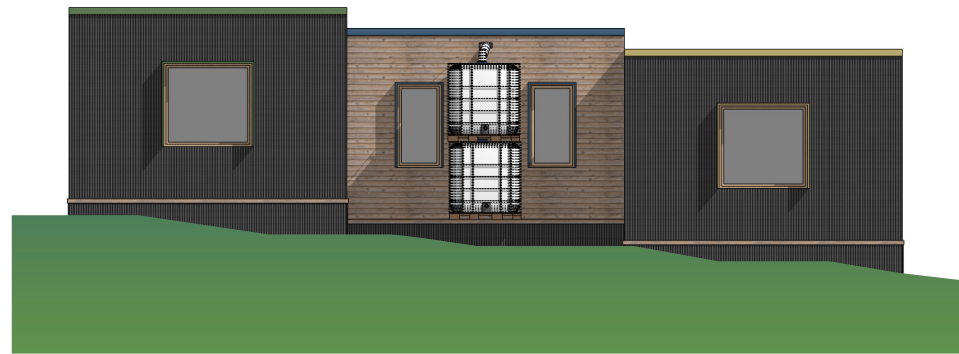
SOLAR



ACCESSIBLE

The corridors, when connected to each other, are offset 3' apart in a jagged array for the formation of new, dynamic meeting spaces. These spaces may encourage a small group to gather or an individual to work independently on a project.



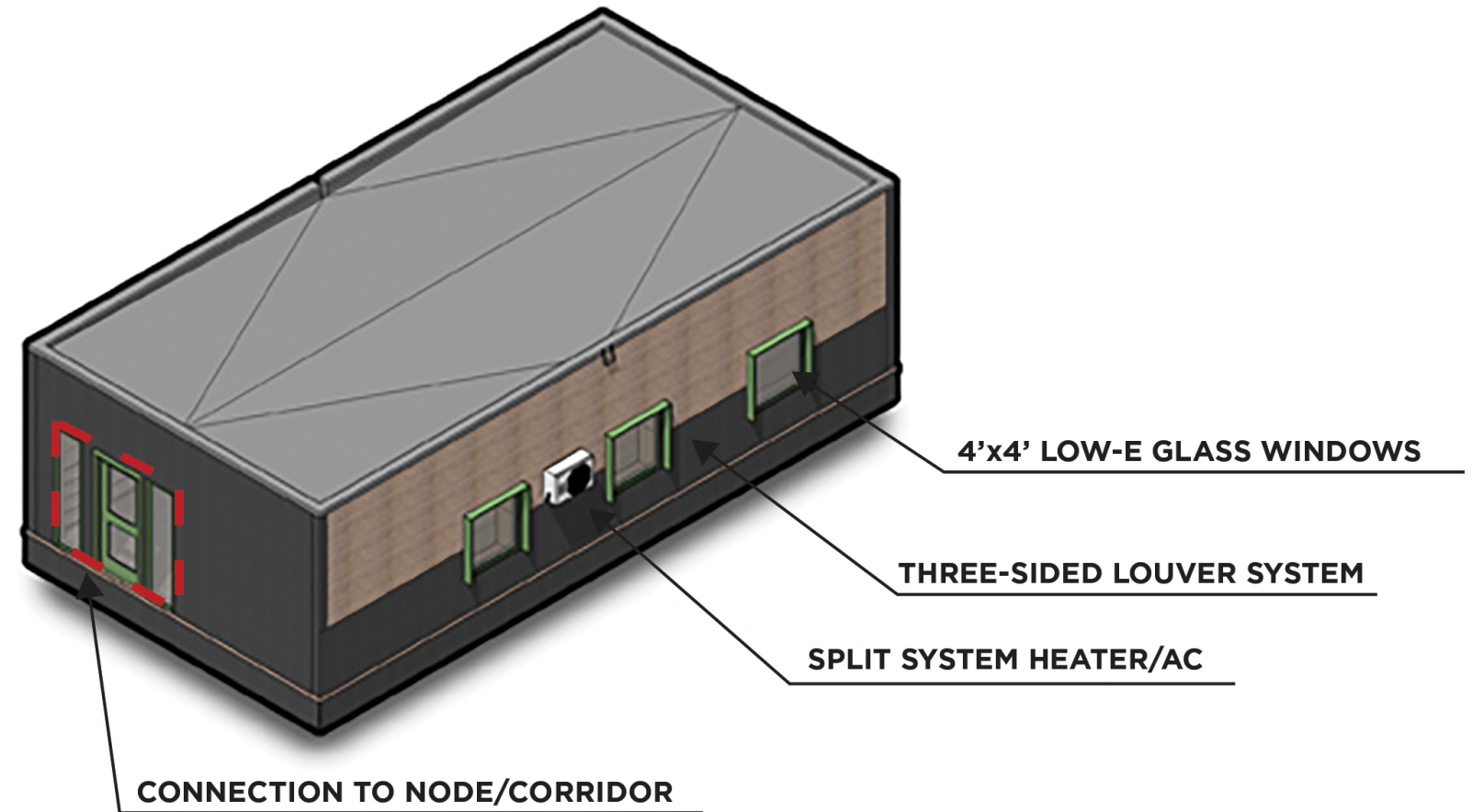


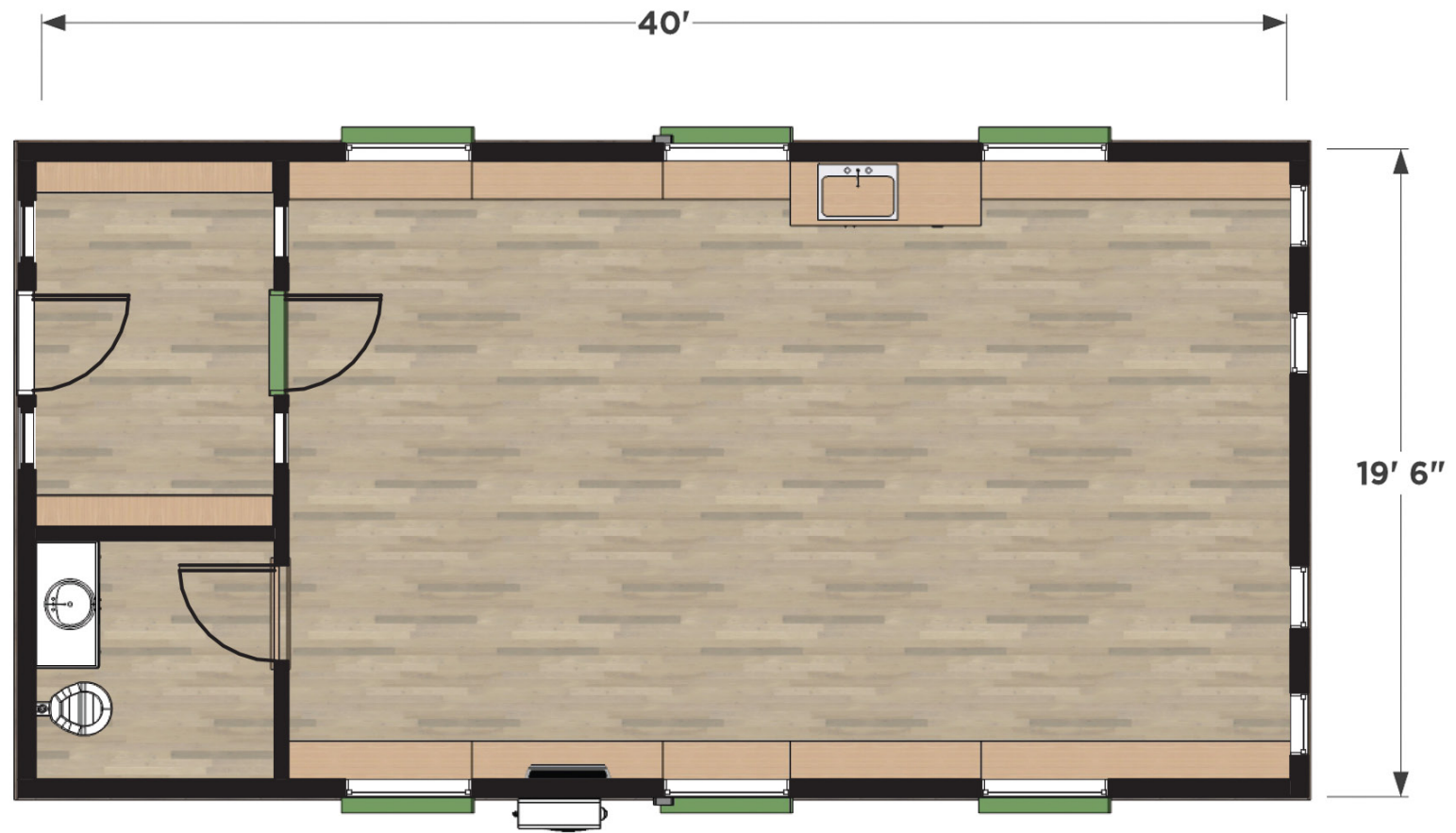


KIT OF PARTS: CORRIDORS

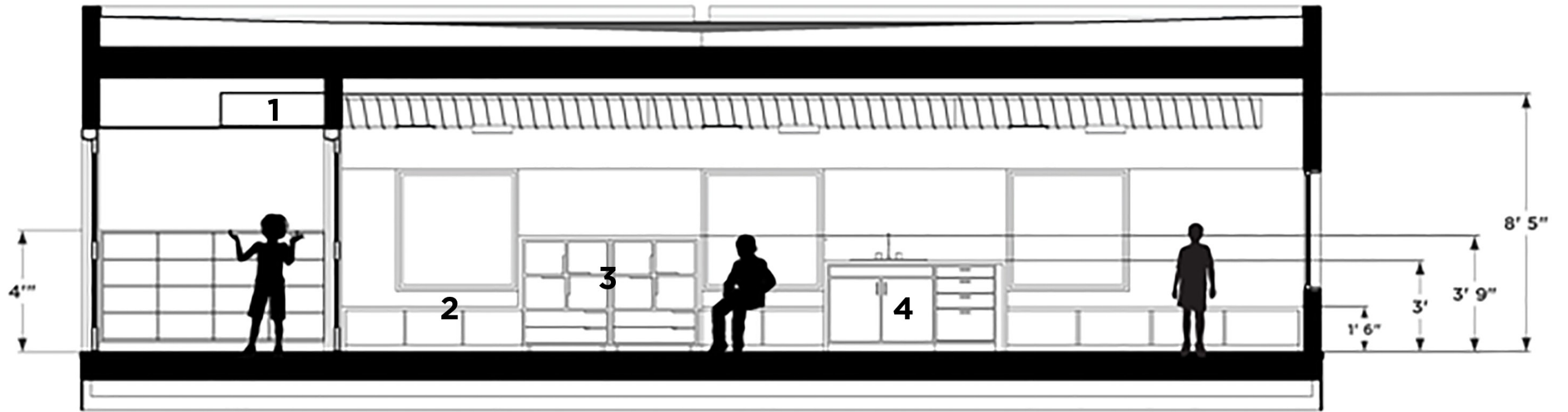
FLEX

In many schools around the country, portable classrooms are used for more than just classroom spaces. Some schools experience a shortage of “flexible” space that can include uses like an art room, music room, or a laboratory. This Flex Room is arranged in a way to accommodate whichever function that the school may need to program. An open floor plan allows for flexibility in furniture arrangements and uses. A large sink is available for a more science or art focused program. Ample amounts of storage are provided along the perimeter of the room for storing craft/art supplies, science equipment, or musical instruments.





KIT OF PARTS: FLEX



SECTION

1 AIR EXCHANGER
3 LAB/ART STORAGE

2 16" STORAGE BENCH
4 LAB SINK



KIT OF PARTS: FLEX



MINOT, NORTH DAKOTA

APPLICATION: MINOT

Minot Daily News

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Overcrowding still present

Minot voters defeated a \$125 million bond issue proposal Tuesday, but school officials said school overcrowding isn't going away.

"Our most urgent need is at the elementary level," said school board president Jim Rostad. "With nine portables at Washington, our number one concern was trying to build a new elementary where we already have the land and also some safety and security issues at some of our schools that are really poorly designed."

At Washington Elementary, nine portable classrooms are in use because the number of students has exceeded the capacity of the building, he said.

Rostad said the board will have to meet to discuss what they want to do next, but he thinks another bond election that would at least fund a new elementary school is likely within the next few months.

If it had been approved, the \$125 million school bond issue defeated Tuesday would have raised money for a number of identified projects, including a new 550 student elementary school on 10 acres of land already owned by the district at the corner of 37th Avenue and 13th Street Southeast, the purchase of land in north Minot and construction of a second 9-12 high school, converting Central Campus into a fourth middle school for the school district, renovating Magic City Campus so it could accommodate grades 9-12 and additions as needed at other elementaries. The failed bond issue would have provided funding for video cameras at school entrances as well as relocating school offices near the front entrance at several schools.

The bond issue in Minot would have also raised the school district mill levy by 51 mills. The owner of a \$200,000 home in Minot could have expected to pay an additional \$456 per year in school property taxes.

A demographer predicts that Minot, which has a current enrollment of 7,400 students, could see an additional 1,000 students enroll within the next five years.

Even though the need for more space at the elementary level is most urgent, Rostad said the other needs won't go away. Within four or five years, enrollment at the middle schools will exceed capacity when there is an influx of new students.

"I think we're eventually going to be faced with all those issues," said Rostad, who said the school board did a lot of research before asking the voters to approve a \$125 million bond issue. "We didn't want to put a Band-Aid on it."

votes.

"We haven't had a bond issue passed since 1969," said Rostad. "I guess I shouldn't have been surprised, but I was disappointed."

Superintendent Mark Vollmer said Wednesday that the district will likely send out surveys to determine why voters rejected the bond issue.

"Half of the people thought it was a great idea or at least an acceptable idea," said Vollmer.

Vollmer said the board will have to meet to determine its next steps. He said one option the board might consider would be a series of smaller bond issues over a period of years, with voters asked to approve funding for projects as the need arises. The board might also ask voters again to approve the \$125 million bond issue, said Vollmer.

"The need still exists," said Vollmer.

Vollmer said it will likely be necessary to redraw district boundary lines to balance out enrollment at schools in the district. Some schools are not yet at capacity, while others are overcrowded. The district will also still seek money through state sources or one-time grant opportunities, said Vollmer.

Minot Daily News

SELECT QUOTES

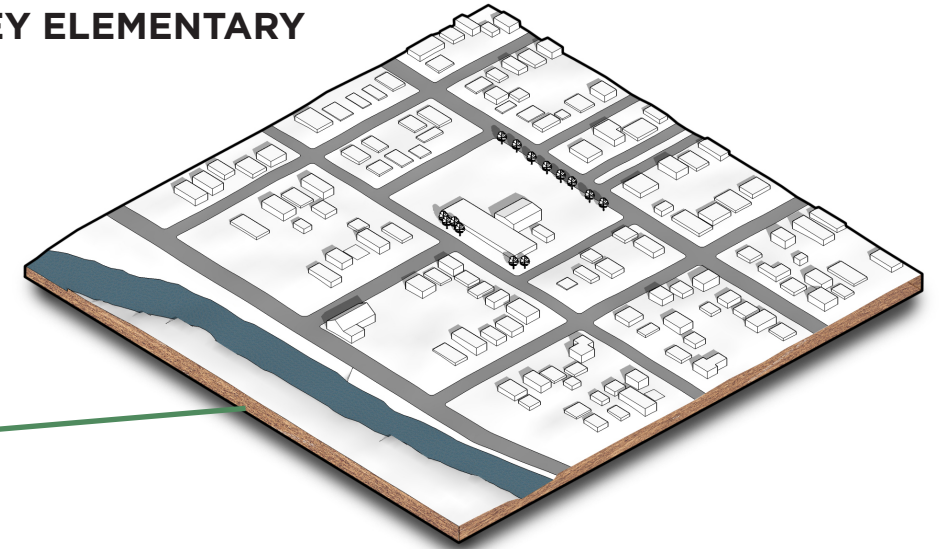
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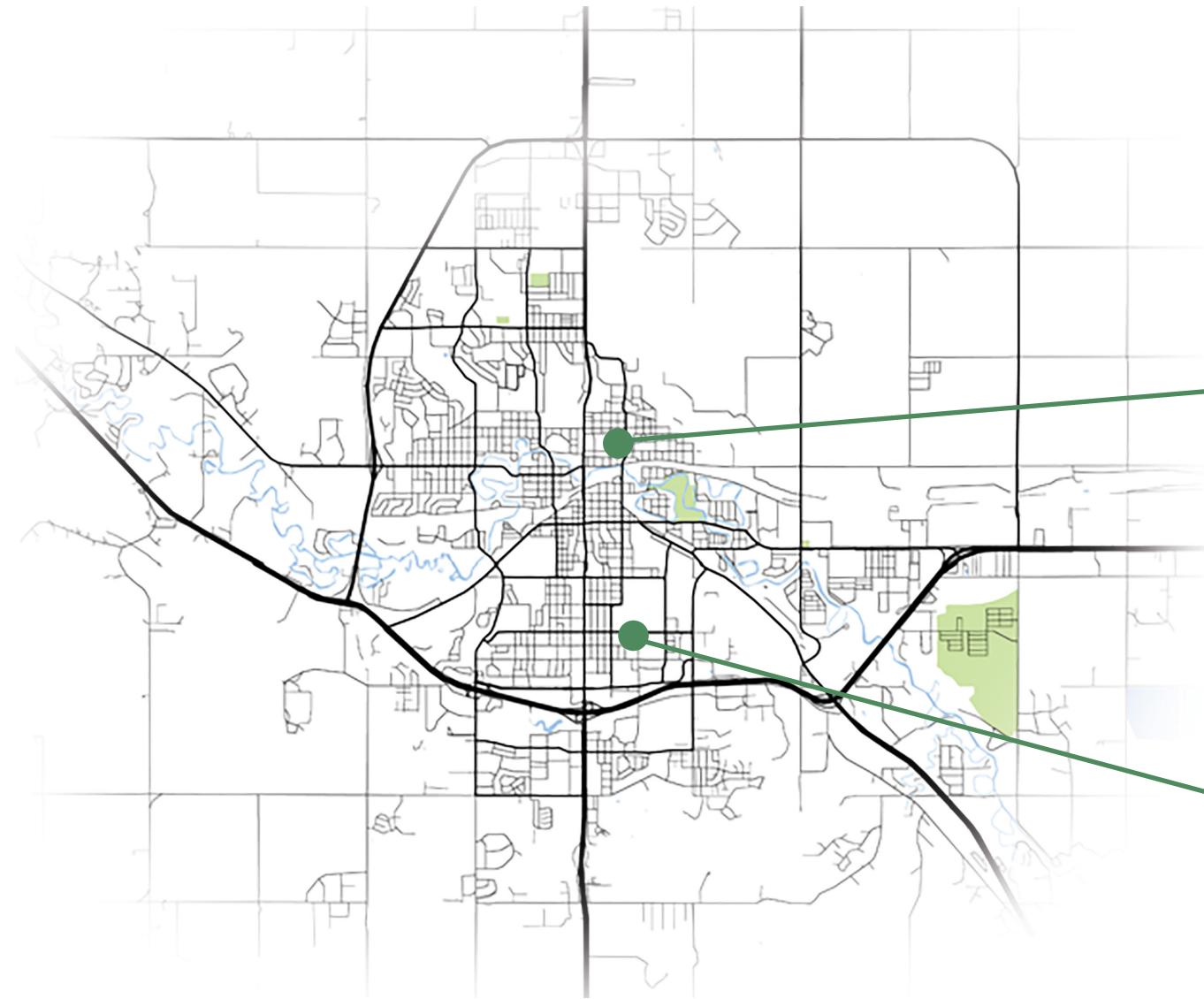
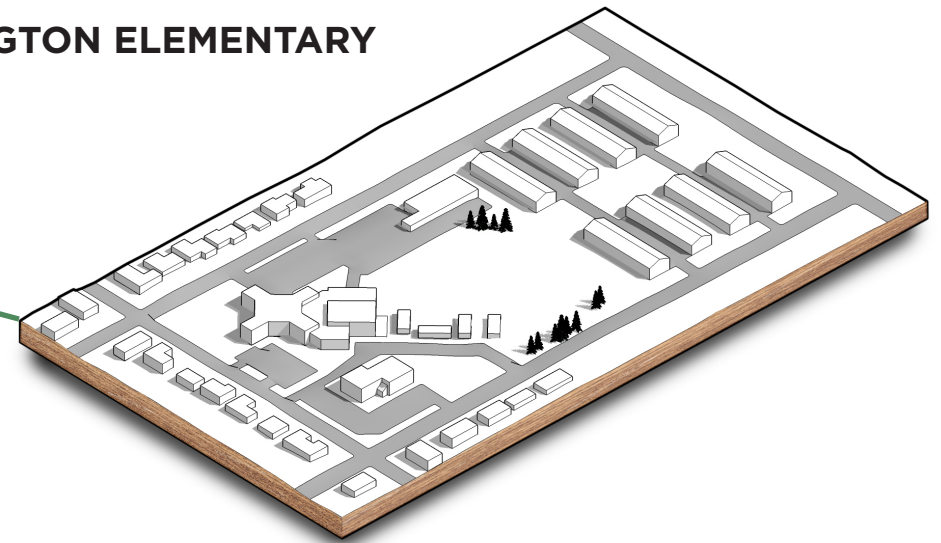
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MCKINLEY ELEMENTARY



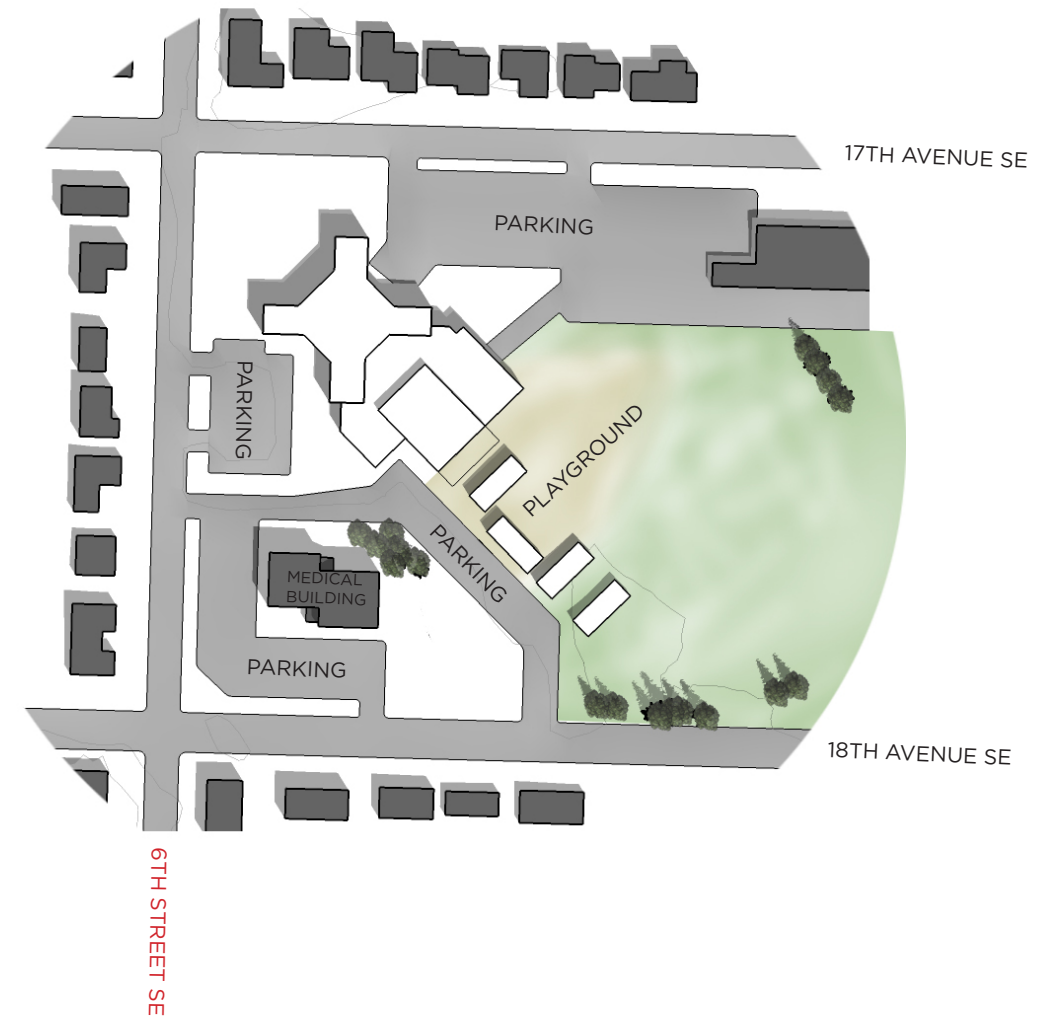
WASHINGTON ELEMENTARY

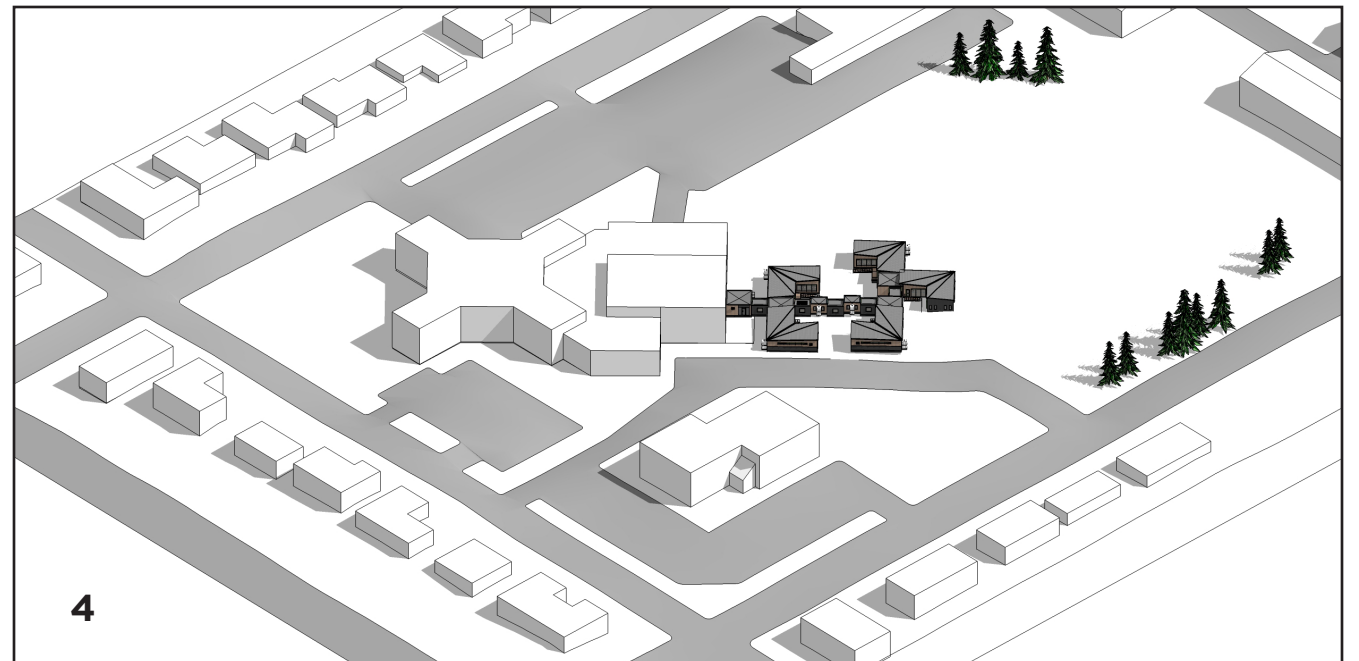
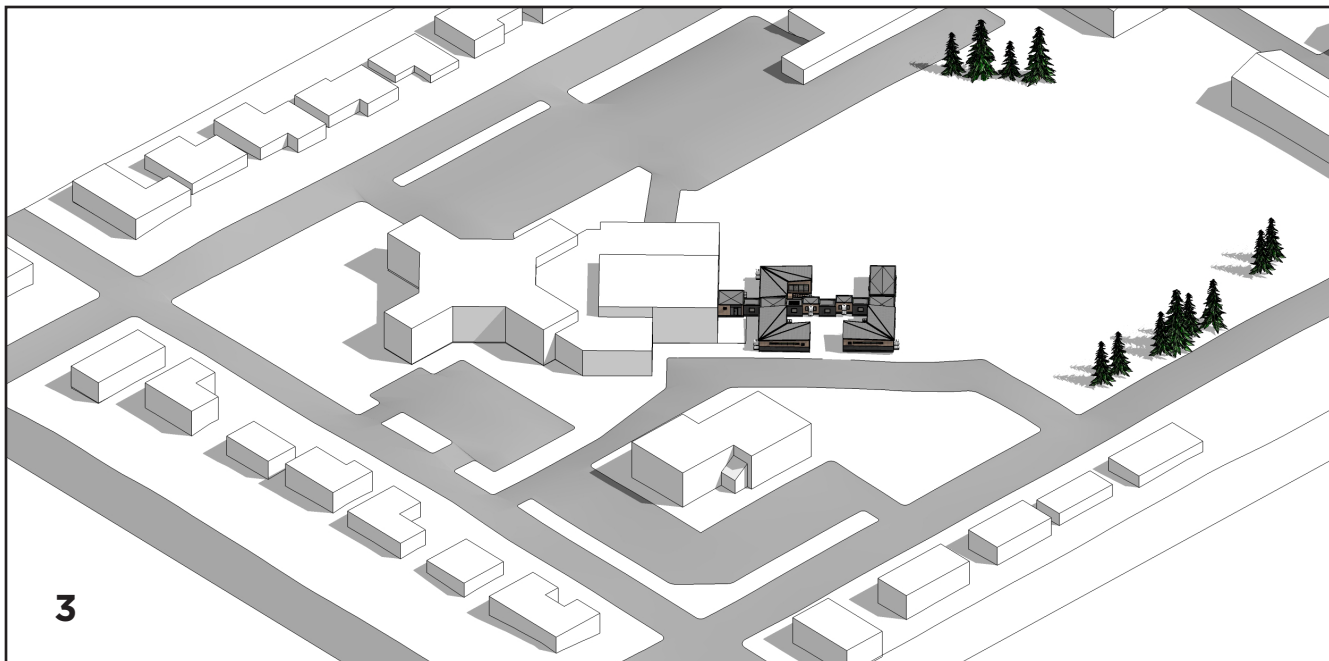
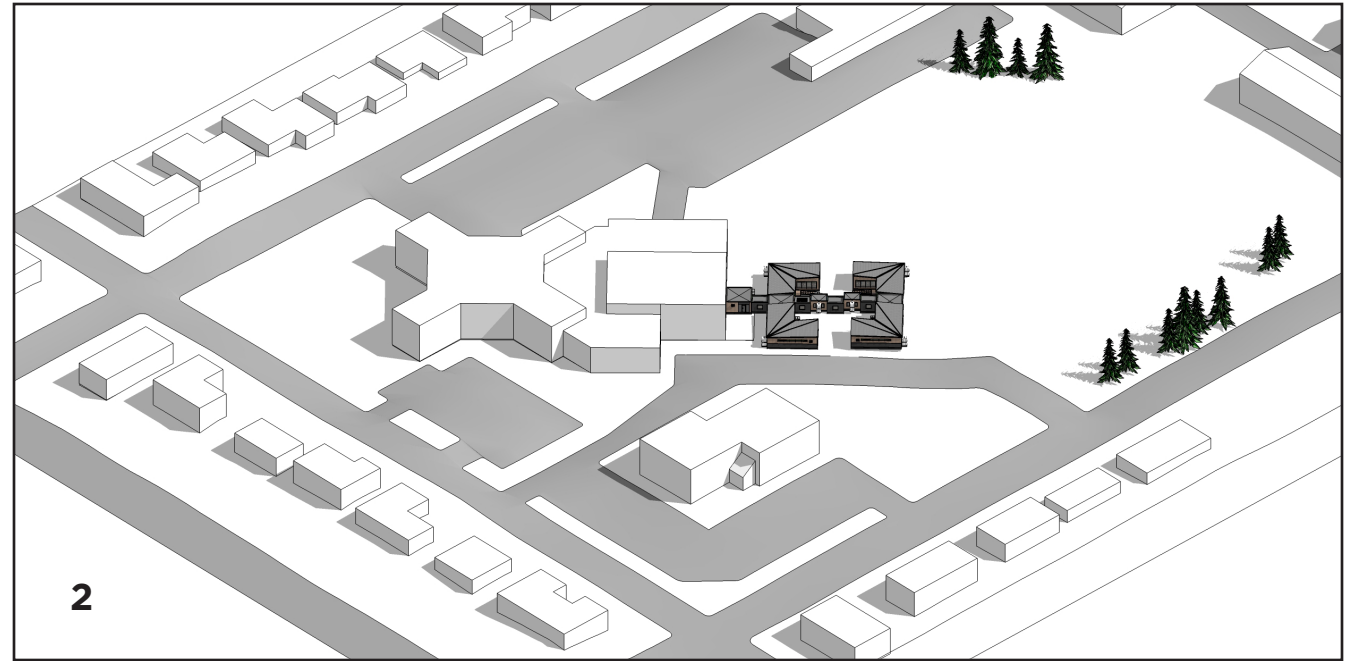
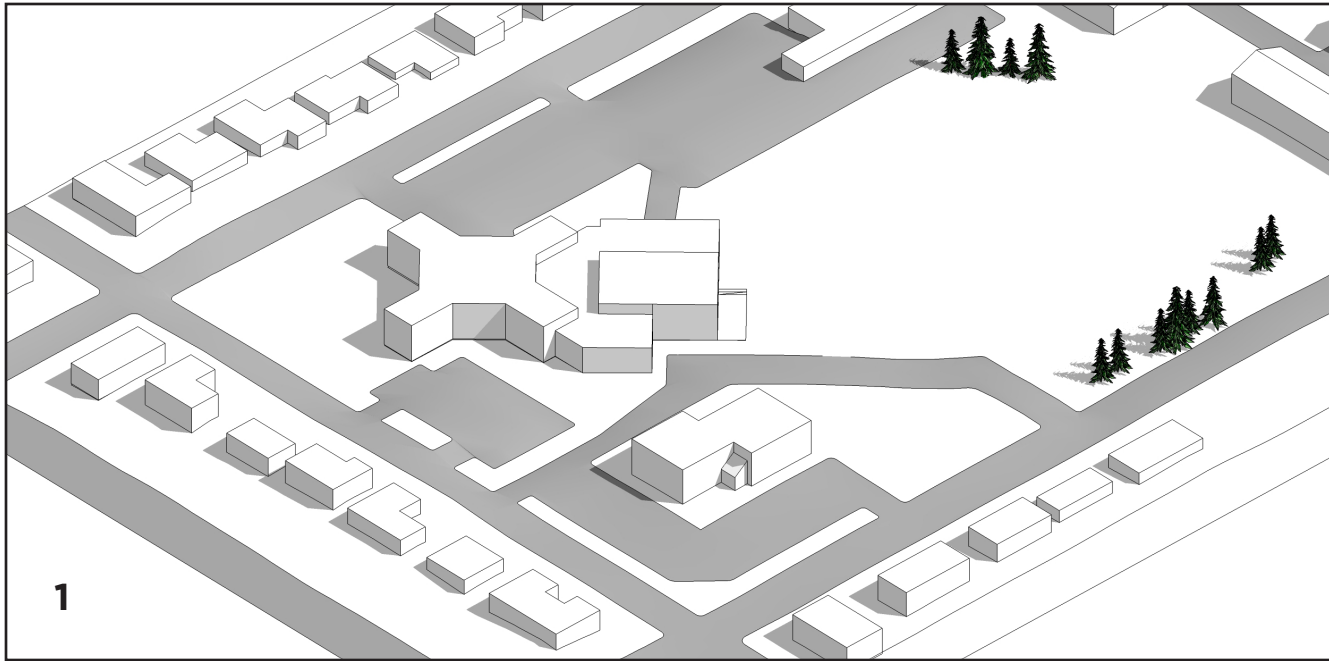


WASHINGTON ELEMENTARY



EXISTING CONDITIONS





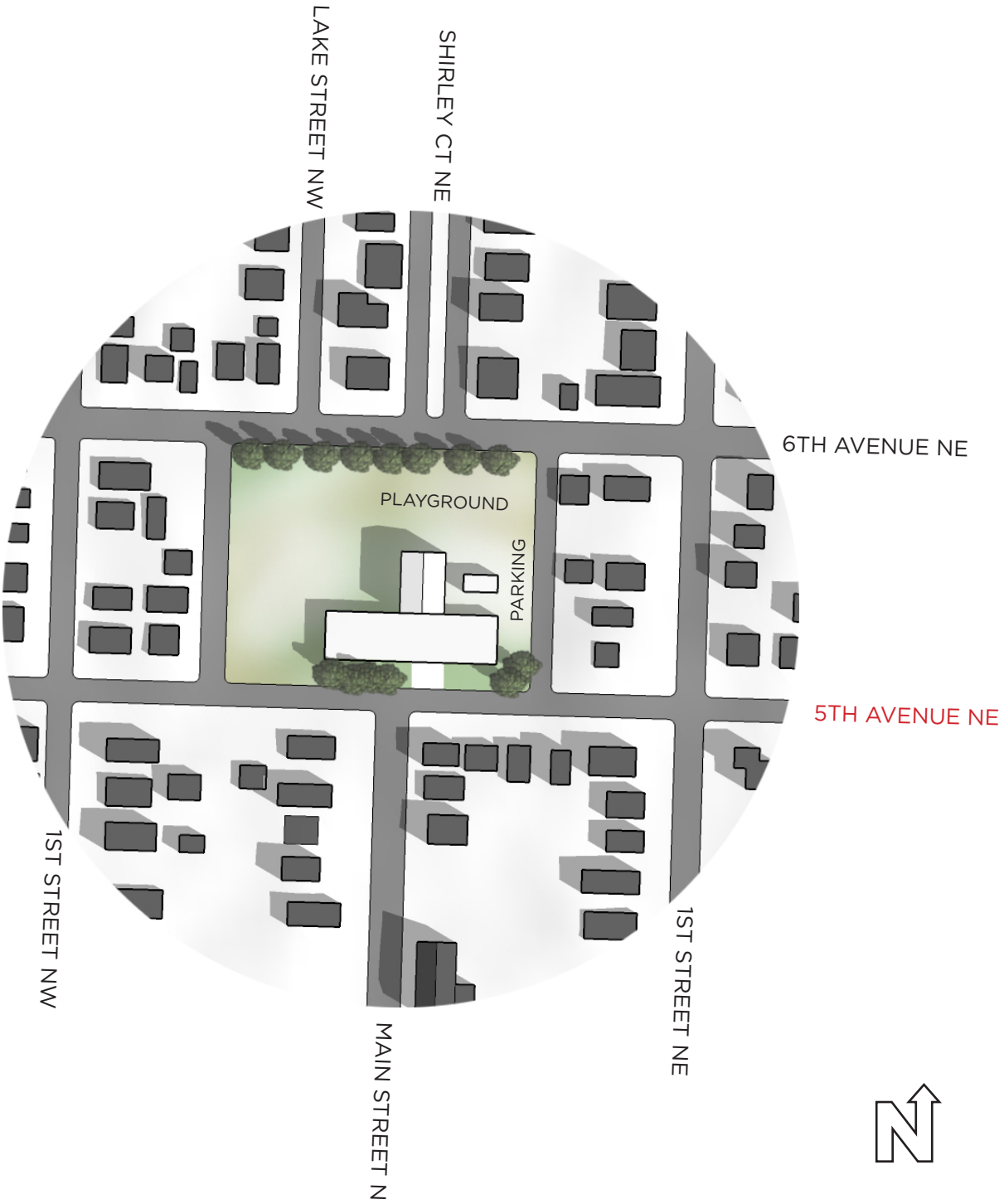


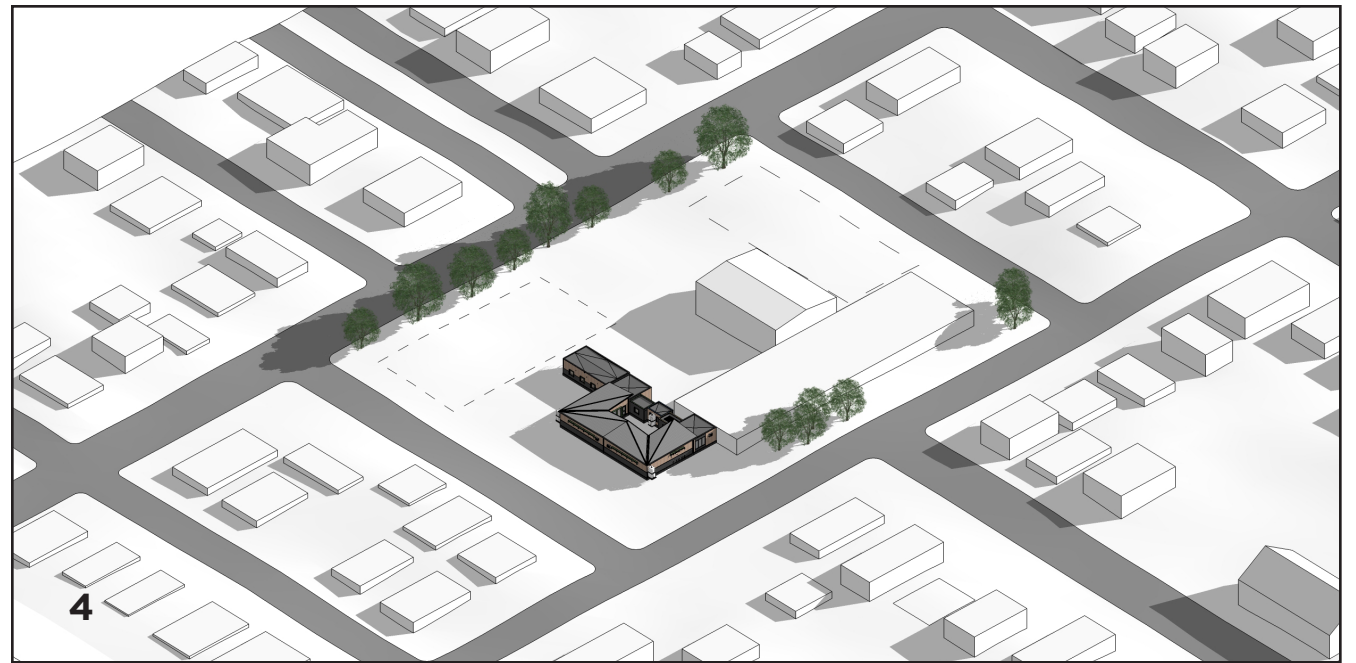
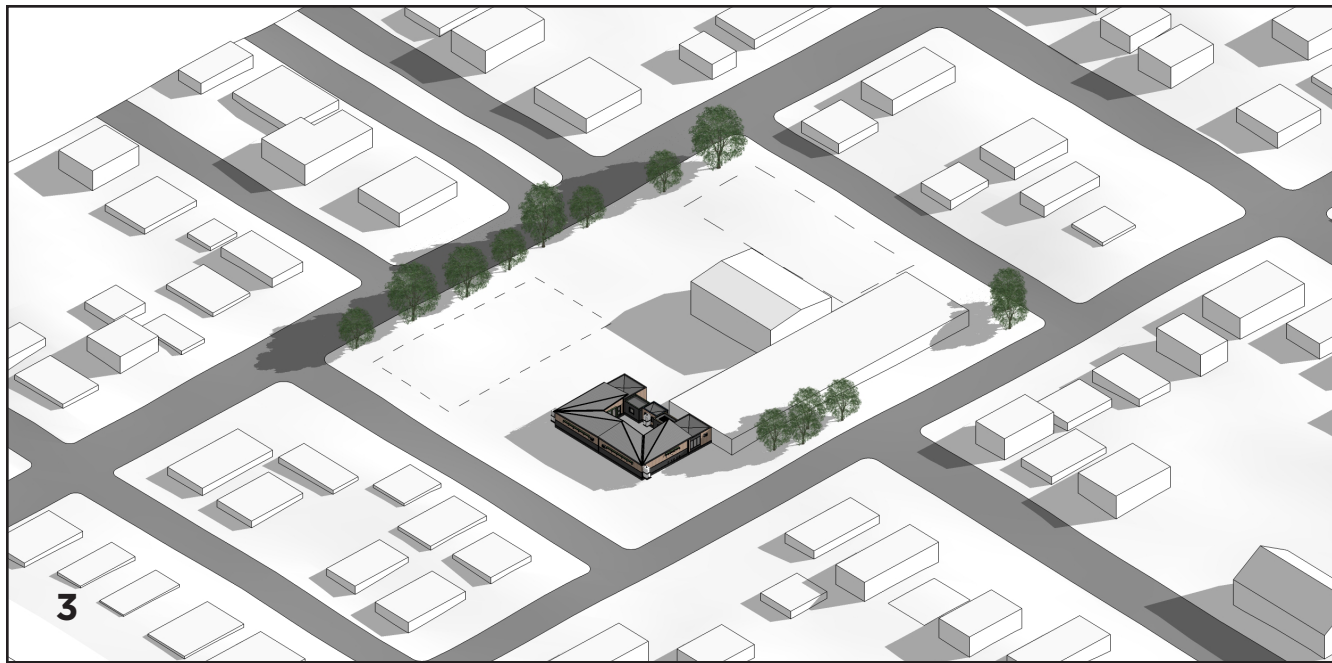
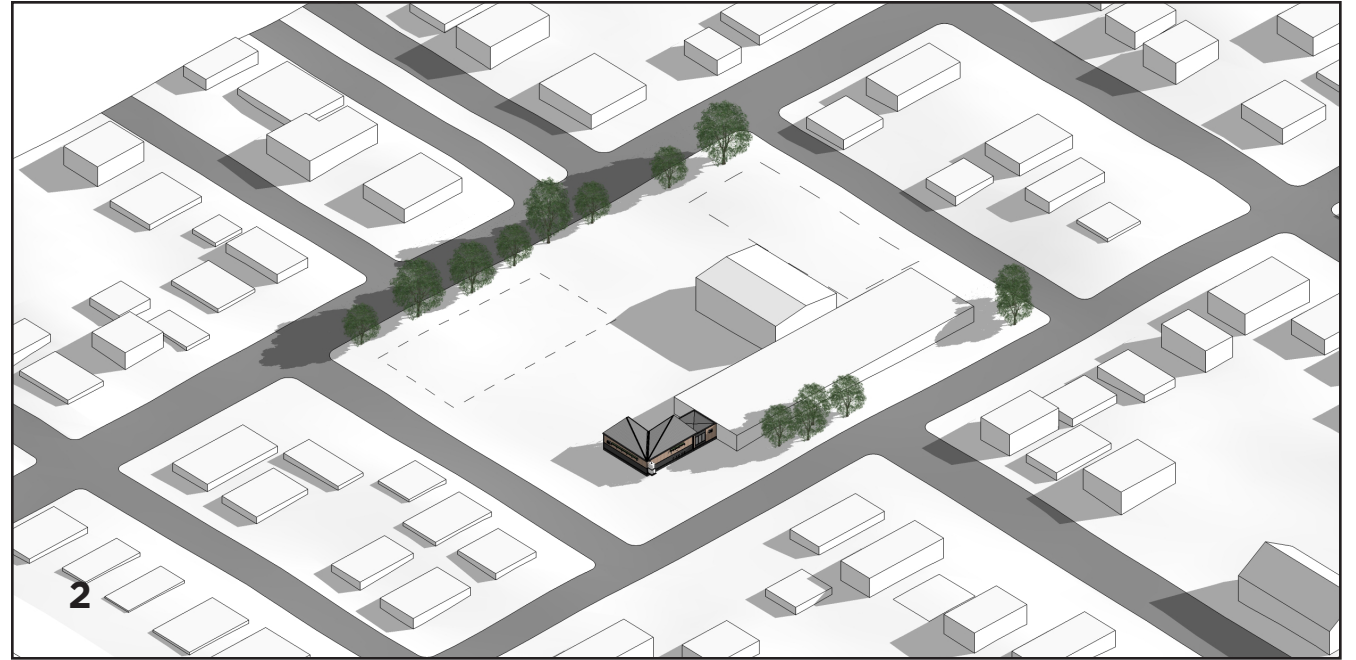
APPLICATION: WASHINGTON ELEMENTARY

MCKINLEY ELEMENTARY



EXISTING CONDITIONS





APPLICATION: MCKINLEY ELEMENTARY



APPLICATION: MCKINLEY ELEMENTARY



APPLICATION: MCKINLEY ELEMENTARY



THANK YOU
QUESTIONS AND DISCUSSION