Bucundura Pre-Primary School Uganda

A Project for Robert Tumwekwase's Home Village
African Educate

Keene State College

Spring 2016

Student Team: Connor Bell, Erin Conti, Brad Donovan

Instructor: Professor Donna Paley

Mentors: Professor Peter Temple, Alice Tasca, Active Social Architecture

Bucundura Pre-Primary School Uganda

PROJECT GOALS

Mission Statement:

We will be designing a school in Bucundura, Uganda to address the desire for mandatory education for this village. Our mission is to design a sustainable, elegant, and culturally appropriate learning center with a community mindset.

Goals/ Objectives:

1. Design usable outdoor learning spaces
2. Have a place for recreational activities
3. Gardening space for both educational and community use
4. Water collection and reuse system
5. To incorporate a kitchen workshop to educate students and community members on the importance of nutrition
6. Provide renewable energy sources

Design Criteria

1. Aesthetic Design:
- community oriented form
- incorporate practical flow from indoor spaces to outdoor spaces
- large space for community members to gather

2. Program
- flexible classroom layout
- large recreational space
- community and educational garden

3.Sustainability
- incorporate solar PV panels
- more efficient water sanitation
- composting toilets

Questions

1. What other uses are you looking for this building to have if any?
2. What type of restroom facilities are needed?
3. Will meals be provided during the school day?
4. Is there an idea or range of a budget for this project?
5. How many students and/or village people are estimated to be using the facility on a daily basis?

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UGANDA SCHOOL
PROGRAM

Uganda Pre-Primary School Program 1/20/2016

INTERIOR SPACES	L	W	SF	# of Spaces	Sub-Total	Capacity/Notes
Classroom Spaces						
Classroom 1	22	15	330	1	330	
Classroom 2	22	15	330	1	330	
Classroom 3	22	15	330	1	330	
Classroom 4	22	15	330	1	330	
Classroom 5	22	15	330	1	330	
Classroom 6	22	15	330	1	330	
Storage	5	10	50	1	50	
					2030	Average sqft required for six classrooms
Professional Spaces						
Teachers Lounge	20	15	300	1	300	
Head Masters Office	15	15	225	1	225	
Bathroom	5	5	25	1	25	ADA
Outdoor Bathrooms	6	7	42	4	168	Outdoor Bathrooms
Storage	5	5	25	1	25	
					743	
Possibilities						
Kitchen	24	12	288	1	288	Separate area
Pantry	6	8	48	1	48	Food supplies
					336	
Sub Total					**3109**	
Mechanical/Circulation Multiplier				15%		
Total Space Needs					**3575**	

EXTERIOR SPACES	L	W	SF	# of Spaces	Sub-Total	Capacity/Notes
Extra Ciricular Spaces						
Garden	15	20	300	1	300	Attached to existing house
Small Playground	15	15	225	1	225	Screened
Storage Shed	6	8	48	1	48	
					573	
Total SF on Site					**~20,000**	
Total SF Needed (SF)					**4148**	

Questions:

- Would it be necessary to have more administrative space?
- Is the storage space too large or too small?
- Program shows average classroom size, is this size acceptable or would more/less be preferred?
- Does the kitchen need to be larger or smaller, could this size accommodate the workshop space?
- Should the classrooms be the same size/ have all the same functions?

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UGANDA SCHOOL

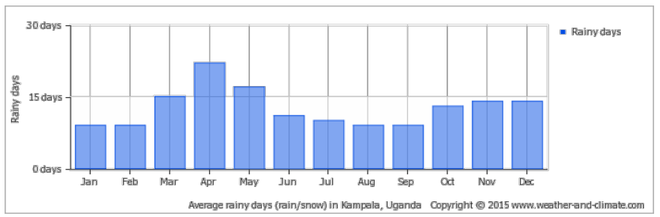
RESEARCH ANALYSIS

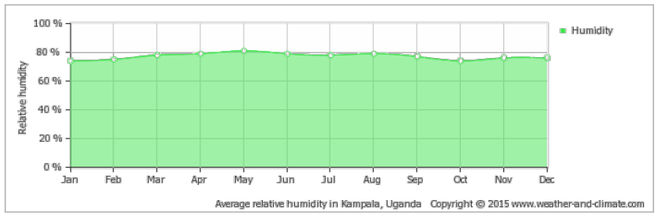
Historical

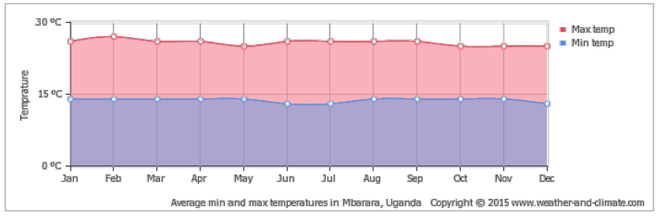
- First missionaries came to Uganda in 1875
- First Roman Catholic missionaries arrived in 1879
- Catholics, Protestants and Muslims all tried to convert Ugandans, but there was hostility to new religions
- 1888 British government gave British East Africa Company control
- Missionaries provided schools for Ugandans in 1900s and literacy became increasingly common
- 1920 executive and legislative councils formed
- World War II Uganda exported wood for war effort
- Riots took place in 1945 and 1949
- by 1950 African members on legislative council was 8
- Uganda became independent from Britain Oct 9 1962
- First Prime Minister in 1966 staged coup and became dictator
- 1971 Idi Amin staged coup and took over - worst tryant of 20th century
  - 100,000 people murdered
  - war with Tanzania
  - fled abroad
- Obote elected after war (rigged election) National Resistance Army eventually took more and more territory and persuaded northern supporters to lay down their arms
- no political parties allowed until 2005 under President Yoweri Museveni
- Today:
  - still mainly agricultural country
  - main export is coffee
  - economy growing
  - population is 35 million

Climate

- Mountain Climate
- small temperature fluctuation
- close to 90 degree angle of sun all year round, 12.1 hours of sun all year long
- precipitation is less than 10 inches in a month and the rainy seasons are March to May and September to November
- washouts will occur due to large amounts of rain quickly
- Humidity stays around 80% all year long
- wind speed is not very strong and consistent through all months
- Gable roofs or shed roofs are neccessity with large overhangs. Building foundation so there is no structure compromise with washouts.







Cultural

Socio-Economic

- The population of Uganda as of the 2014 census was 34 millon
- The average household size in that census was 4.7 people
- The education system is flawed in Uganda and although law may dictate required attendance there is no enforcement of these laws with such rural villages and miles between residents and judicial systems

- **Food/Agriculture**
  - Traditional cooking with English, Arab, and Asian influences
  - Meat, beans, sauces, starches, and vegetables are basic meal staples
  - Goat is more commonly consumed as opposed to beef because of availability
  - Fruit is always served fresh and sugar cane can serve as a nice sweet treat
  - Most rural areas grow their own food on their own properties eating what they grow rather than selling excess
- **Transportation**
  - local transportation consists of bikes, taxis, and moto-taxis, which are efficient and cheap
  - Buses travel from more urban areas and don't normally have routes to pick up passengers in rural areas, walking is a very popular option
- **Disease**
  - Common diseases are Malaria, Tuberculosis, and 60% of deaths in Uganda are related to maternal complications and nutritional issues. Malnutrition is the number one killer of children under the age of 5
  - healthcare systems are not a governmental priority

Educational

- Two basic levels of education
  - primary and secondary
- Very few make progress to university and other tertiary institutions
- gap between primary and secondary school enrollments
- classes not based on age
- 1997 Ugandan government introduced universal primray education (idea that all children should be able to attend primray school for free)
- unfortunately demand for free education outweighs availabilty of places at free government schools
- school year: February - December
- not uncommon for classes to have over 100 students with very little facilities and unqualified teachers
- other option is private school which vary in fees
- Paying school fees is beyond many families
- Primary school education
  - four main subjects: English, Math, Science, SST (social studies: includes geography, history, religious studies)
  - also option of agriculture depending on the school

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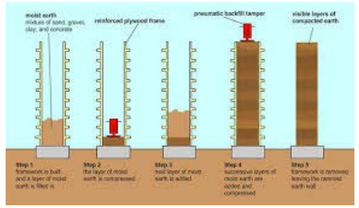
UGANDA SCHOOL
RESEARCH ANALYSIS

Design and Construction

- **Wall Materials**
  - Sun Dried Bricks
  - Burnt Bricks
  - Timber
  - Cemen
  - Compressed Earth Blocks
- **Roof Materials**
  - Composite Beam and Panel Roofs
  - Filler Slab Roofs
  - Unreinforced Masonry Roofs
- **Rammed Earth Building**
  - Produced with blocks made from sandy soil
  - Soil is shoveled into frame
  - First layer is compressed
  - Second layer added, process repeated as needed
- **Earthbag Building**
  - Uses earth-filled polypropylene bags stacked up.
  - Barbed wire in between layers
  - Finish product coated with concrete
- **Compressed Earth Block Building**
  - Uses damp soil in mechanical press to create blocks
  - Can be mixed with chemical to stabilize
  - Assembled using standard bricklaying techniques

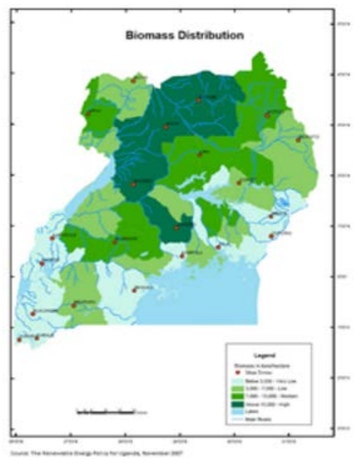


Impacts and Challenges

- Abundance of rain will impact the kinds of materials that may be used
  - rain may deteriorate certain materials
  - noise of rain against roofing materials
- providing ventilation, while still preventing rain from getting inside the facility
- Must keep in mind this will be a multifunctional building
- Soil that may be taken will affect rain diversion
- lack of use of potential renewable energy (and cost) will make providing a cost effective energy source difficult

Soil Data

- The region that we are designing for is in the Southern end tip of Uganda
- Data shows
- farming land for coffee, bananas, and cattle
- clay-filled topsoil with proterozoic rock underneath
- underdeveloped land
- This area is mostly for farming and is mountainous meaning it will be difficult to get any machinery or large materials to the school site. Site offers the ability to use compressed earth blocks because of soil contents



Uganda's Energy Profile

Sources: Encyclopedia of the Earth (2015). *Energy Profile of Uganda.*
Uganda Ministry of Energy and Mineral Resources (2012). *Discovery of Oil in Uganda.*
Renewable Energy Focus (2010). *Uganda's Renewable Energy Potential.*
World Bank (2013). *World Development Indicators.*
United Nations Environment Program (2012). *National Workshop on Promoting Sustainable Solutions for Africa.*

ENERGY POTENTIAL	
Wind	Unascertained
Solar	200 MW
Geothermal	450 MW
Peat	800 MW
Biomass	1,650 MW
Hydroelectricity	2,200 MW
TOTAL	5,300 MW

ACTUAL INSTALLATION	
Wind	Nil
Solar	Negligible
Geothermal	Nil
Peat	Unascertained
Biomass	125 MW
Hydroelectricity	680 MW
TOTAL	810 MW

Resource Challenges

Natural Resources
arable land
70-80% of population employed by agricultural industry
Abundant rainfall
The country has largely untapped reserves of both crude oil and natural gas.
Uganda's extractive industry activities have focused on commercial mining of cobalt, gold, copper, iron ore, tungsten, steel, tin and other industrial minerals such as cement, diamond, salt and vermiculite.

Renewable Energy Potential
Biomass resources
Firewood, charcoal, crop residues
Solar
Wind
Geothermal
Hydrological
With exception of biomass, only a fraction of country's renewable energy potential is used
Other renewable sources of energy (excluding hydropower) contribute to less than 2% of Uganda's total energy consumption

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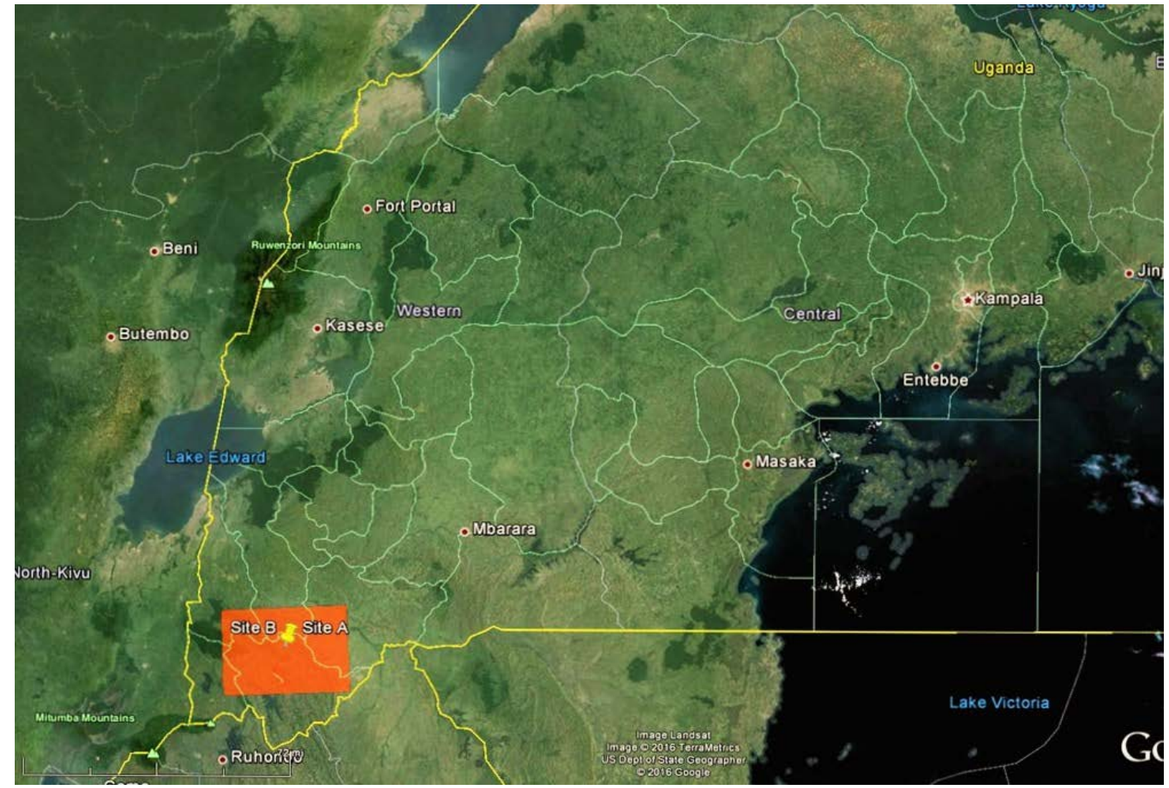

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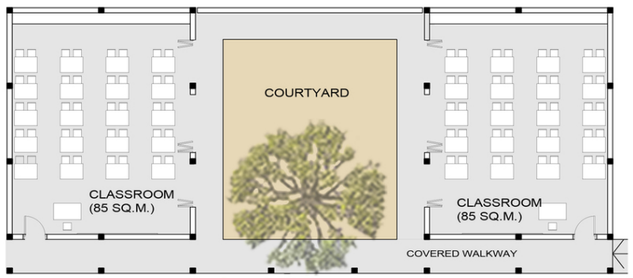
PRECEDENT STUDY

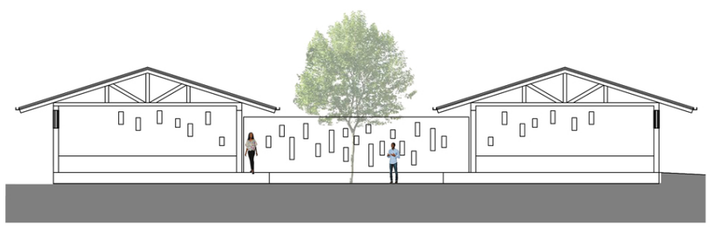
CLASSROOM LAYOUTS AND SIZE

YWAM Hopeland Jinja Uganda

- 85 SQ. M. (915 SQ. Ft.)
- 40 Students to a Classroom
- 3 sliding doors with a standard door
- Courtyard allows for a break out space



TYPICAL GROUND FLOOR PLAN



TYPICAL SECTION

by Reiss Design Studio

Kasese Humanist Primary School

7 Classrooms
24 to 32 Students
1 Computer Lab
1 Examination Hall
48 Students
1 Exit in Front of Classroom

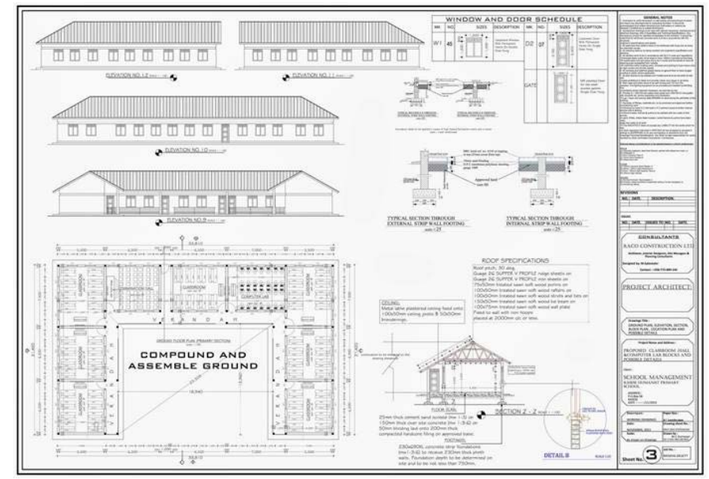


Photo of plans for New Kasese Humanist Primary School

Sample Classroom for progressive Teaching

- 900 SQ. FT.
- Allows for different learning areas
- Small area group work
- Progressive teaching

by Community Play Things

Global Housing & Development Group School

Three Classroom Block
Rooms 20'x20"
24 Small Desks
One Rear Exit

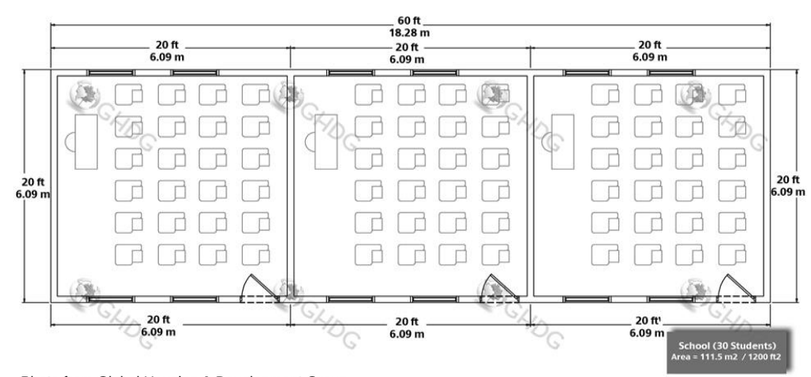


Photo from Global Housing & Development Group

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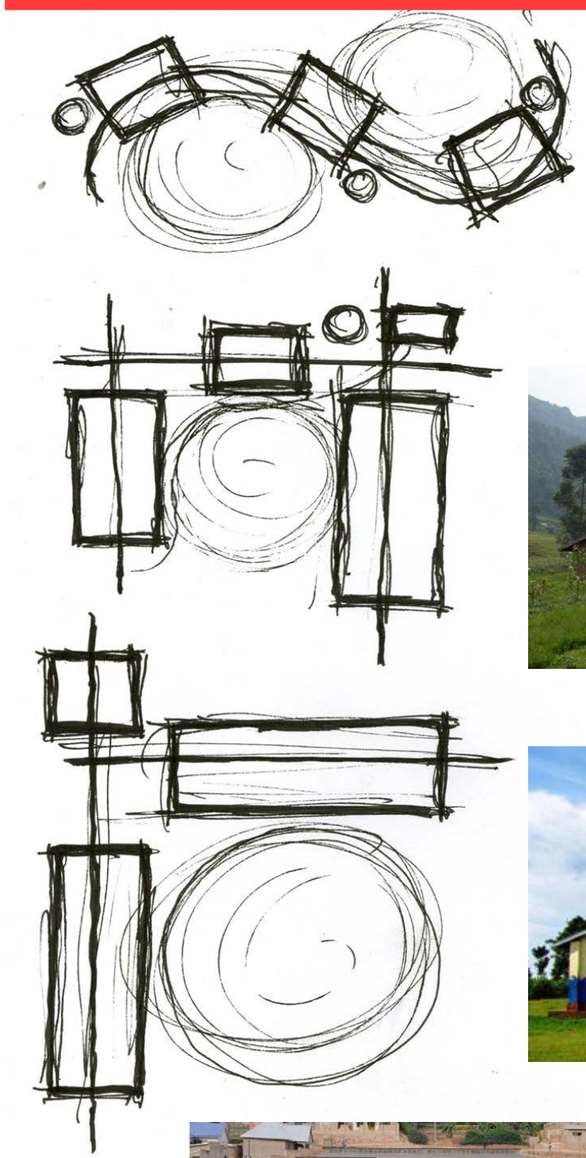
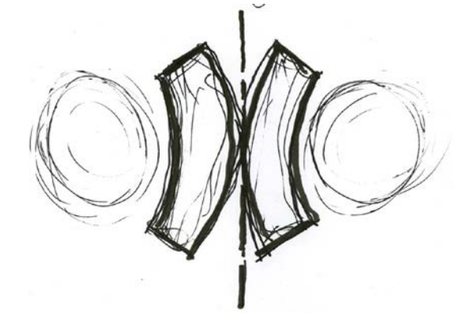
PRECEDENT STUDY

SITE LAYOUTS



Active Social Architecture
Kigali Rwanda
Early Childhood Education/ Community Center

- S-shaped layout design
- Flow from indoor space to outdoor
- Transitions from indoor spaces to indoor spaces with covered walkways
- Two outdoor play spaces in proportion to attendance



Bucundura Existing School Design
Bucundura Uganda
Primary/ Secondary School

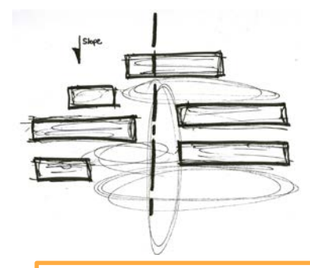
- Open outdoor “courtyard/quad” space
- Flow from indoor to outdoor
- Does not address slope as well as it could have
- Community space. recreation space centralized

Kyabirwa Primary School
Kyabirwa Uganda
Primary School

- Large open outdoor space
- Axial plan with an L-shaped scheme
- No smooth transition from one structure to another
- Realatively flat site, which was dealt with nicely

Ilima Primary School
Ilima Rwanda
Primary School

- 2 curved spaces
- Central hallway
- 2 outdoor parallel recreational spaces
- Symmetrical



The Umubano Primary School
Umubano Rwanda
Primary School

- Elegantly addresses dramatic slope
- Uses large recreation space to connect structures
- Axial plan down the slope with structures offsetting eachother
- Terracing done downward

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PRECEDENT STUDY

MATERIALS AND CONSTRUCTION ASSEMBLY

Primary School- Mali

-Barrel vaulted primary school built in Mali completely out of compressed earth blocks, including the arched roof

-The main form of the school is three main classrooms in the center with two covered verandas on either side

lly along with an office space and storage

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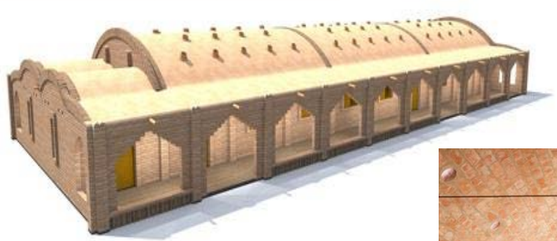

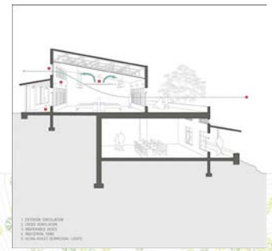

Rwanda Hospital

Mass Design Group

Michael Murphy

To design the hospital we made use of local materials – such as nearby volcanic rock from the Virunga Mountains – and labor intensive practices to deliver appropriate and sustainable design as well as stimulate the local economy through employment.

The 97,000-square-foot complex consists of a dozen cantilevered cubes, wrapped in brilliant white stucco and integrated with 15,000 square feet of outdoor areas, art studios, a running track and other communal spaces. The finished project will provide 102 housing units.

Volcanic stone is a ubiquities element of the northern Rwandan landscape. When used in building, it is typically only for foundations or courtyard walls, and is often covered partially or completely with mortar. In an effort to reveal the exceptionally unique and beautiful texture of the stone we sought to minimize mortar, and create an even and nearly seamless expanse of deep gray porous walls.

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PRECEDENT STUDY

MATERIALS AND CONSTRUCTION ASSEMBLY

Small World School- Nepal

School built in Nepal using the Earthbag construction method

Process involves stacking dirt-filled bags up course by course

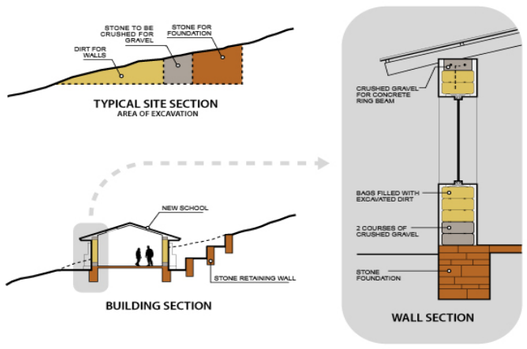
Barbed wire placed in between each course for added strength and rigidity

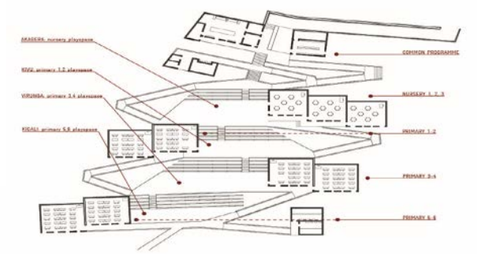
Finished walls are covered with mesh and then plastered or covered with concrete to give a finished masonry look

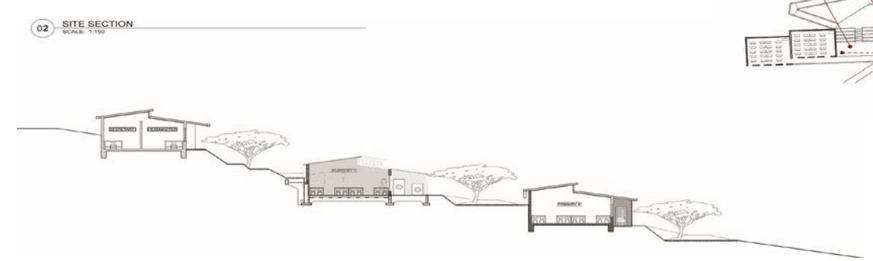
They then can be painted

Very useful for locations where materials and machinery are limited

Permanent structures







Rwanda Primary School
Mass Design Group

Michael Murphy

Kigali, Rwanda

900.0 sqm

MASS created unique settings for learning with a mix of interior rooms, exterior teaching areas, and terraced play spaces for children. Local materials such as brick and papyrus reeds were used in the construction to cut down on transportation costs, limit the use of imported and often contextually inappropriate materials, and to spur the region's economy by encouraging local markets.

The design employs natural ventilation strategies, and the verendeel trusses in the roof structure create clerestory lighting in order to reduce energy consumption

7 buildings with 9 classrooms, library, computer lab, kitchen, and administrative space, Mixed interior rooms and exterior teaching areas, Terraced play spaces

The school is built on a hillside. The slope is pretty steep more than 45° in some places

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PRECEDENT STUDY

ENVIRONMENTAL CONSIDERATIONS

Ventilation and Daylight

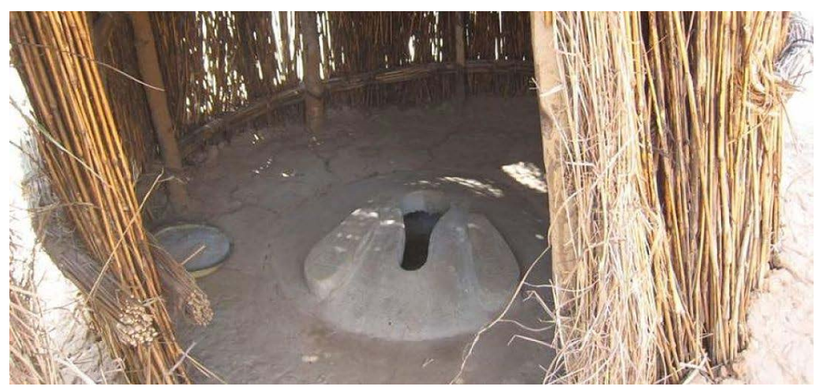
- Oxygen levels allow for students learn better
- Temperature affects the learning capability as well (optimal temp. 72 degrees F)
- Lighting influences the learning as well, natural is the best (30% direct, 70% indirect)
- Passive solar heating
- Large over hangs to keep light off the building and for downpour of rain

Power & Light

- Solar power for electricity
- Wind power to consider
- Shading with trees is cheap and effective

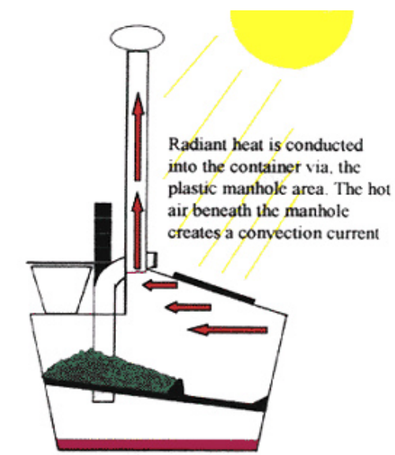
Water

- Scarce at best and isn't always the cleanest
- Storage tanks for freshwater
- Collection of Rainwater to use as grey water
- Wells can also be useful if they are able to be dug



Sanitation and Toilets

- Normally just a hole in the ground
- Do not use composting or normal toilets because there is no social acceptance of it
- Sanitation is not the cleanest and water being contaminated
- Keep toilets and showers in a building all themselves
- Use rainwater as shower water and toilet water



The increased internal temperature speeds up the rate of evaporation - dehydration and therefore decomposition of the solid waste.

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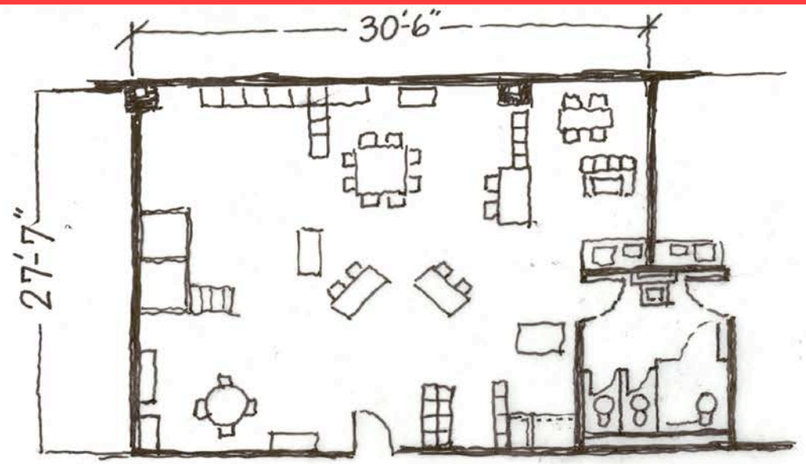
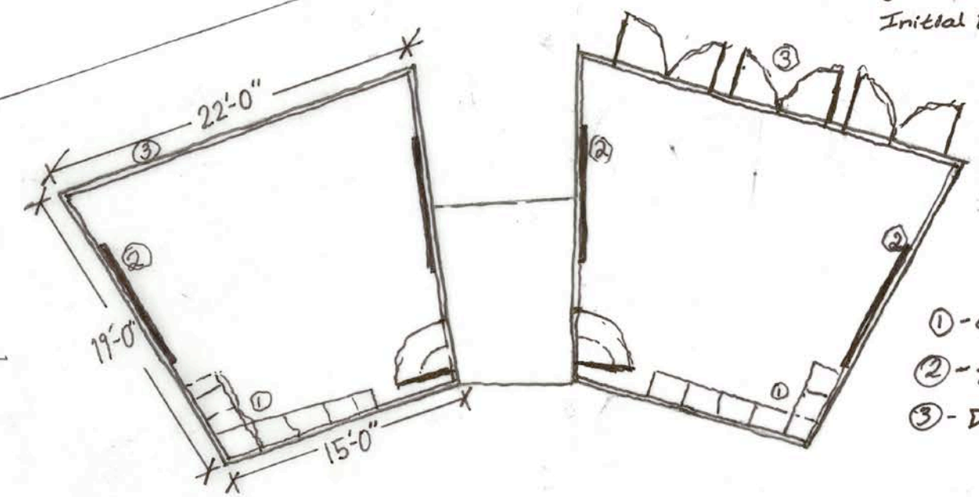
Classroom Preliminary Research



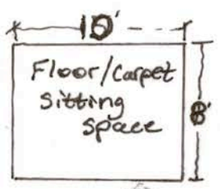
DIVISION OF SCHOOL FACILITIES

*KINDERGARTEN

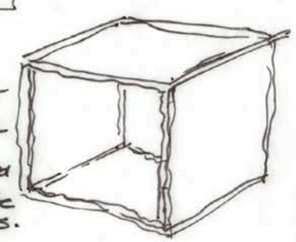
LAYOUT = 1000 Sq. ft

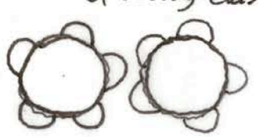


Preschool: 1'x1'x1' cubbies



- 2 sq ft per student on carpet
- Doubles as indoor playspace
- 2 round tables for organized activities 5 students/table splitting class into two groups.





20 Kids / class room

- Preschool 40 students
- Kindergarten 40 students
- 1st grade 40 students

Classrooms: * NOT TO BE PLACED IN EACH INDIVIDUAL CLASSROOM

Preschool

- Floor space (carpet)
- cubby spaces
- Tables
- nap spaces
- * Bathrooms
- * wash station
- Teachers Cabinet
- Chalk Board

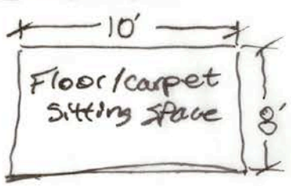
Kindergarten

- More Tables (organized)
- cubby spaces
- Floor space
- Teachers Cabinet
- Chalk Board

1st Grade

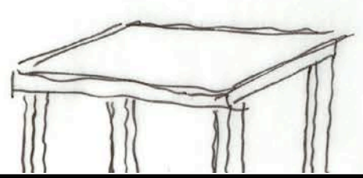
- Individual Desks (linked)
- Individual cubby/storage
- Teachers Storage
- Blackboard
- Bookshelves/ extra storage

NDERGARTEN:



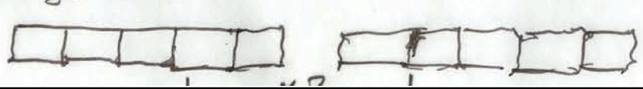
- 2 sq ft per student on carpet/mat
- Doubles as indoor playspace
- 4 round tables w/5 students per table for organized activities.

t Grade:



Desk size = 1'-6" x 1'-0"

Arrangement =



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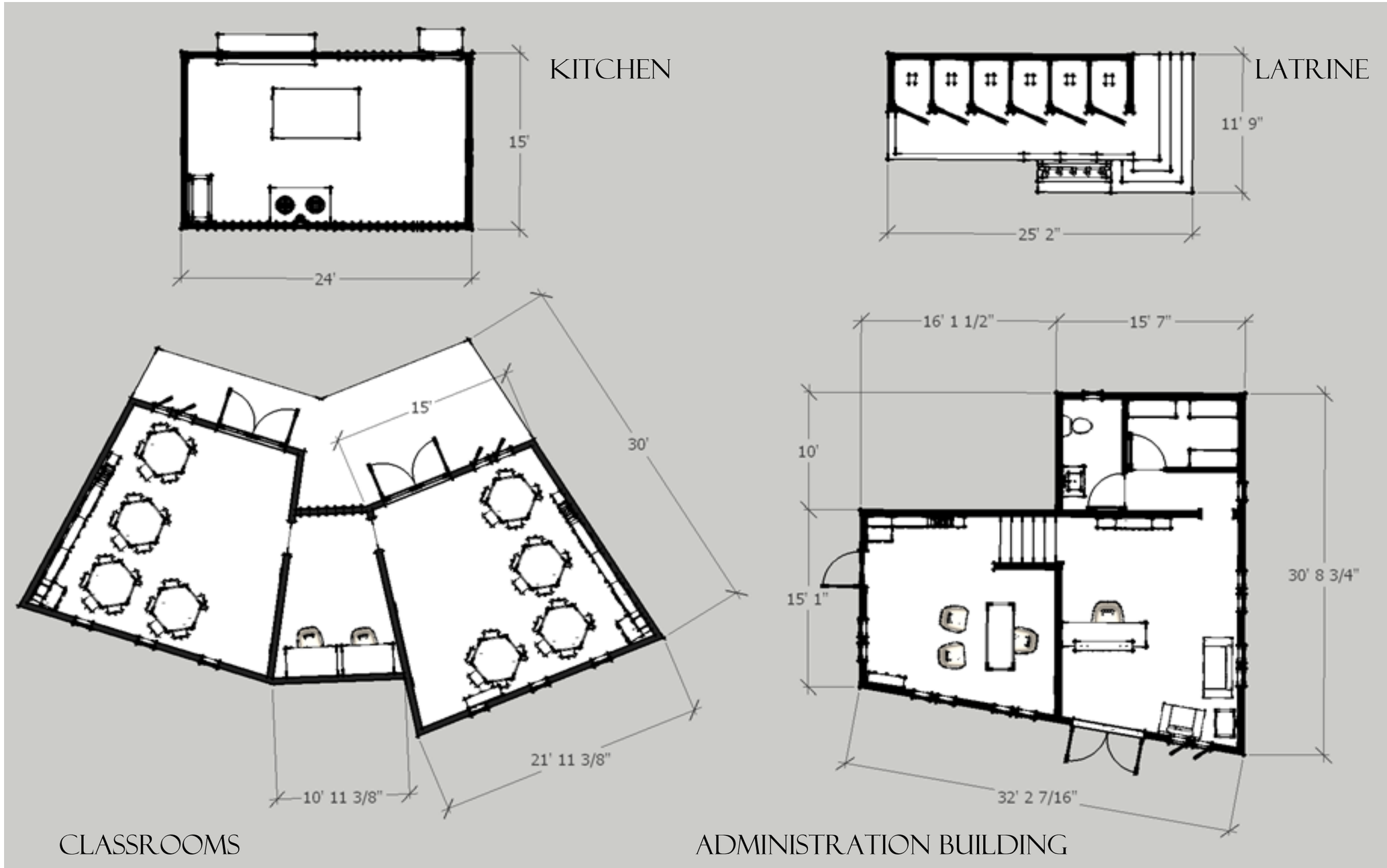
Dimensions of Floorplans



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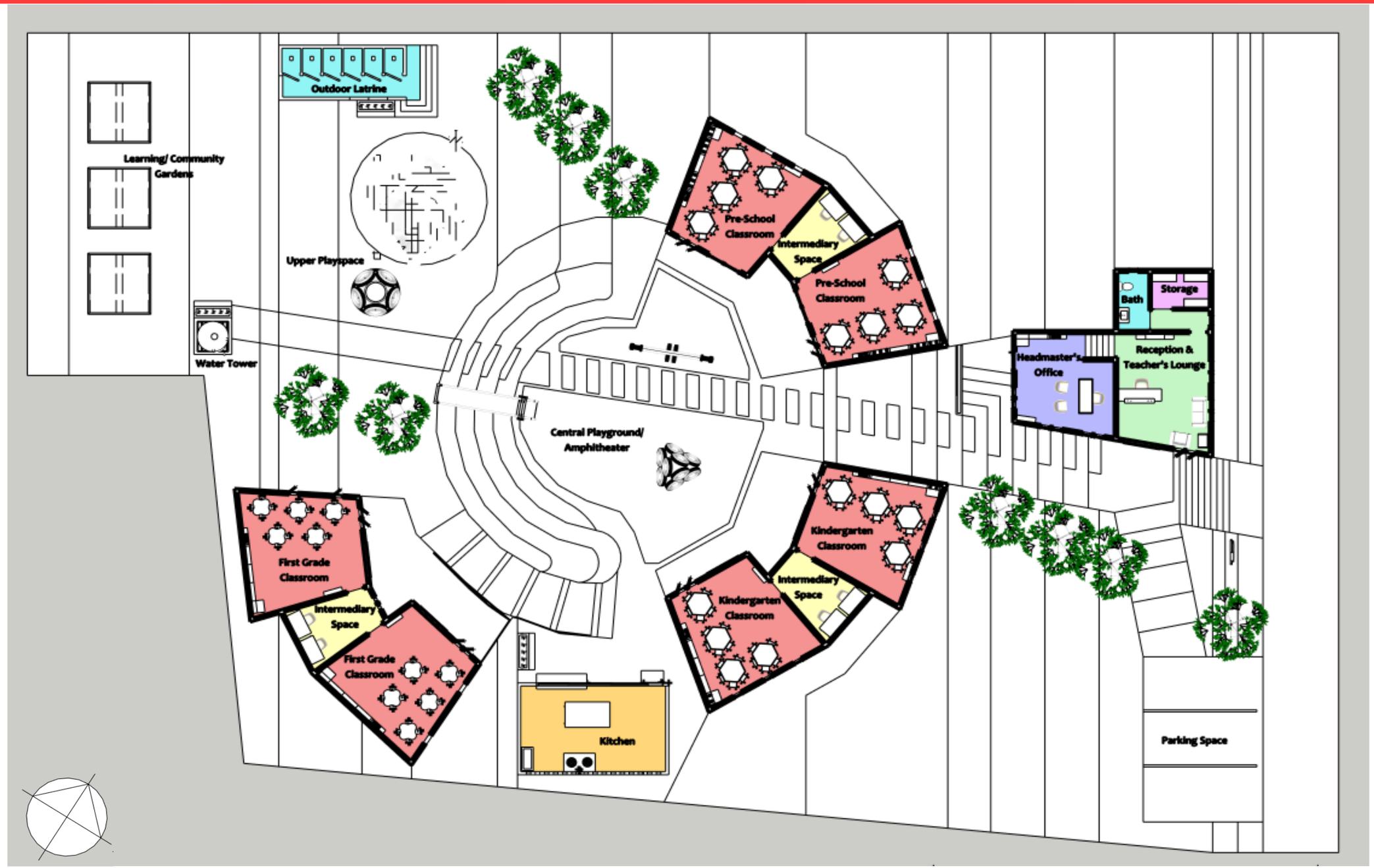
Floorplans on Site with 2’-0” Contour Lines



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Finished Site Plan with Corresponding Landscape Features

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Section Cut of Entire Site Along Central Path Axis

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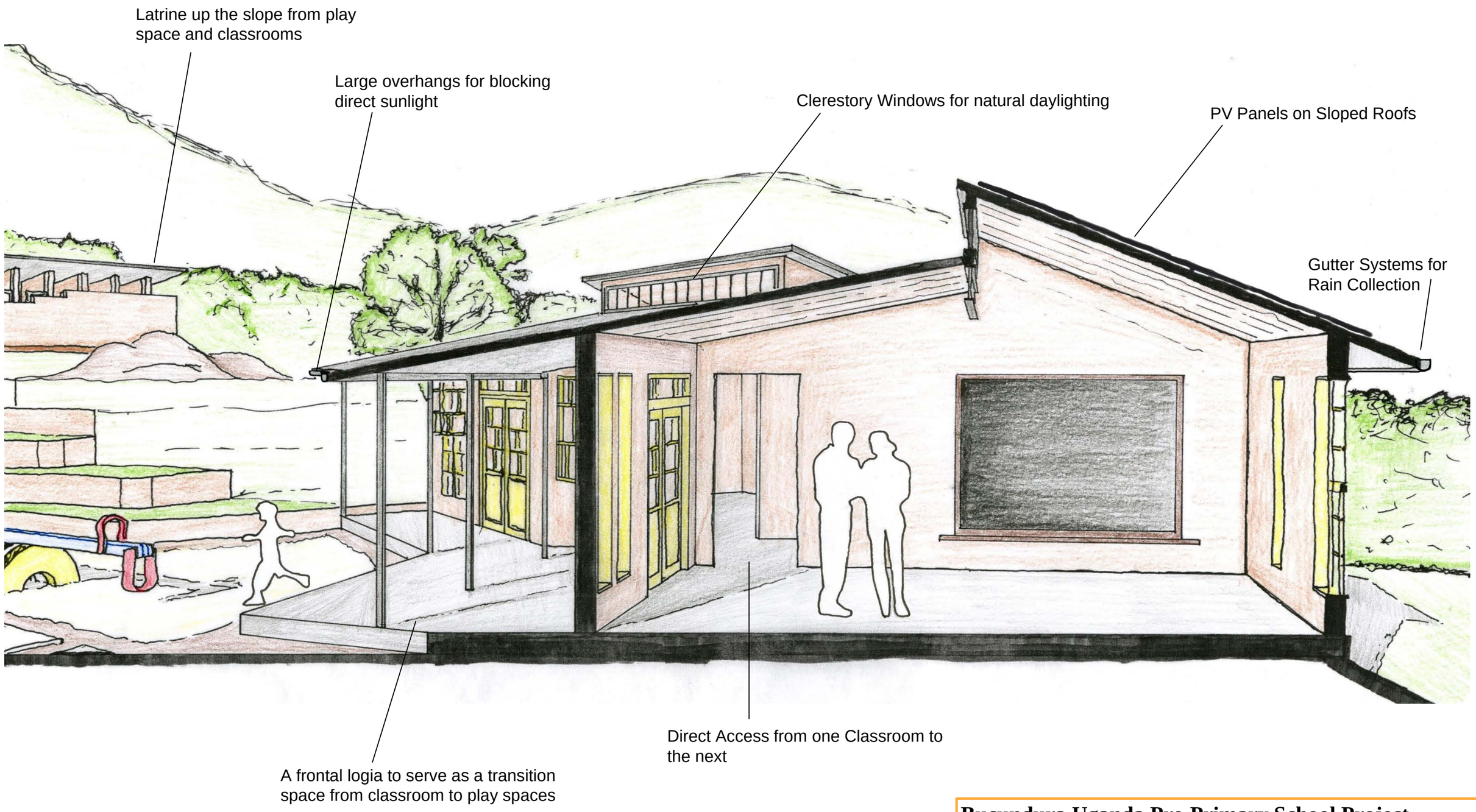
Section Cut of Pre-School Classroom with Labeled Elements



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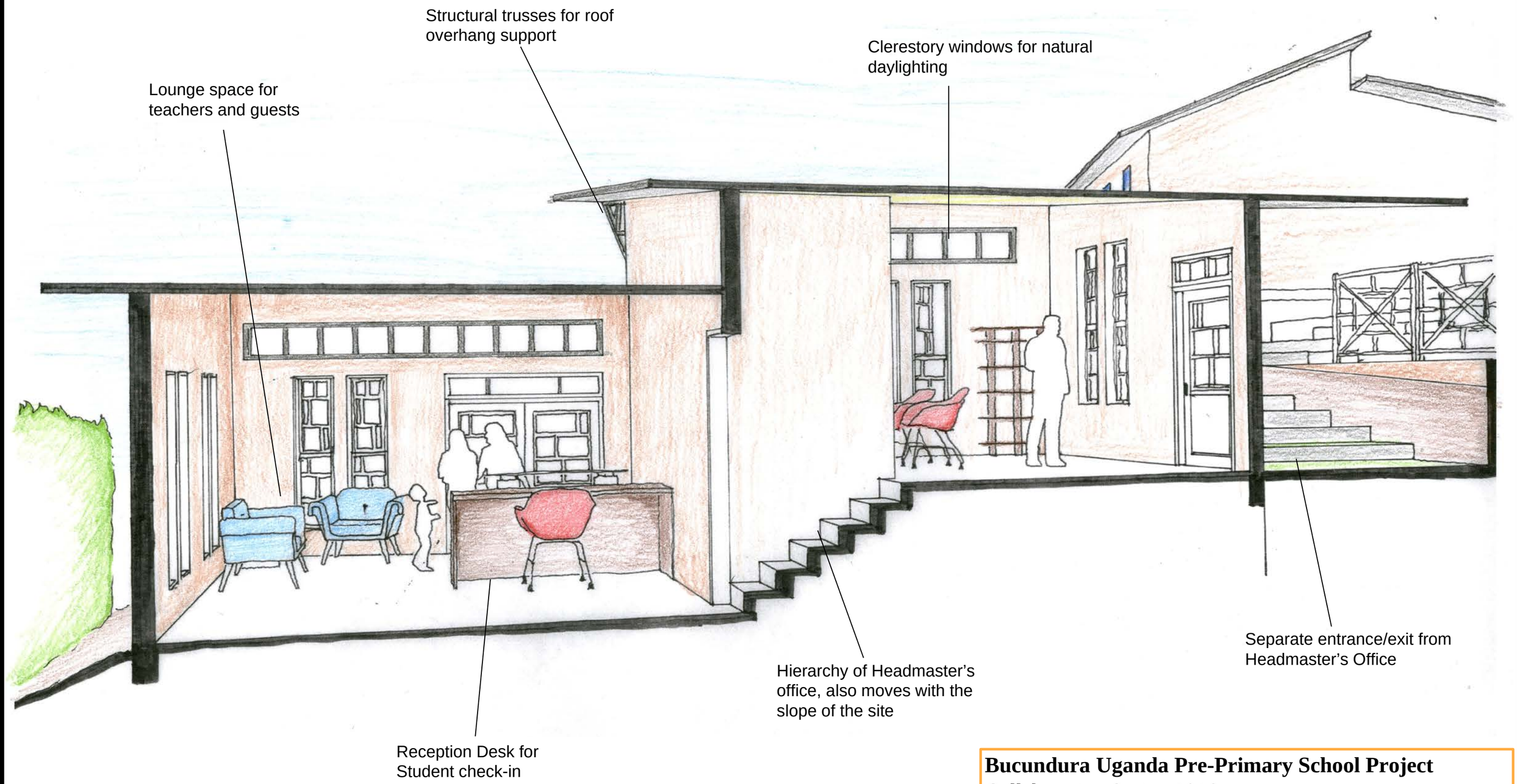
Section Cut of Administration and Reception Building



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View of Entryway and Administrative Building

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View of Amphitheater, Play Space, and First Grade Classrooms

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View Across Play Space to Pre-School Classrooms

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View of Kindergarten Classrooms, Kitchen, and Amphitheater

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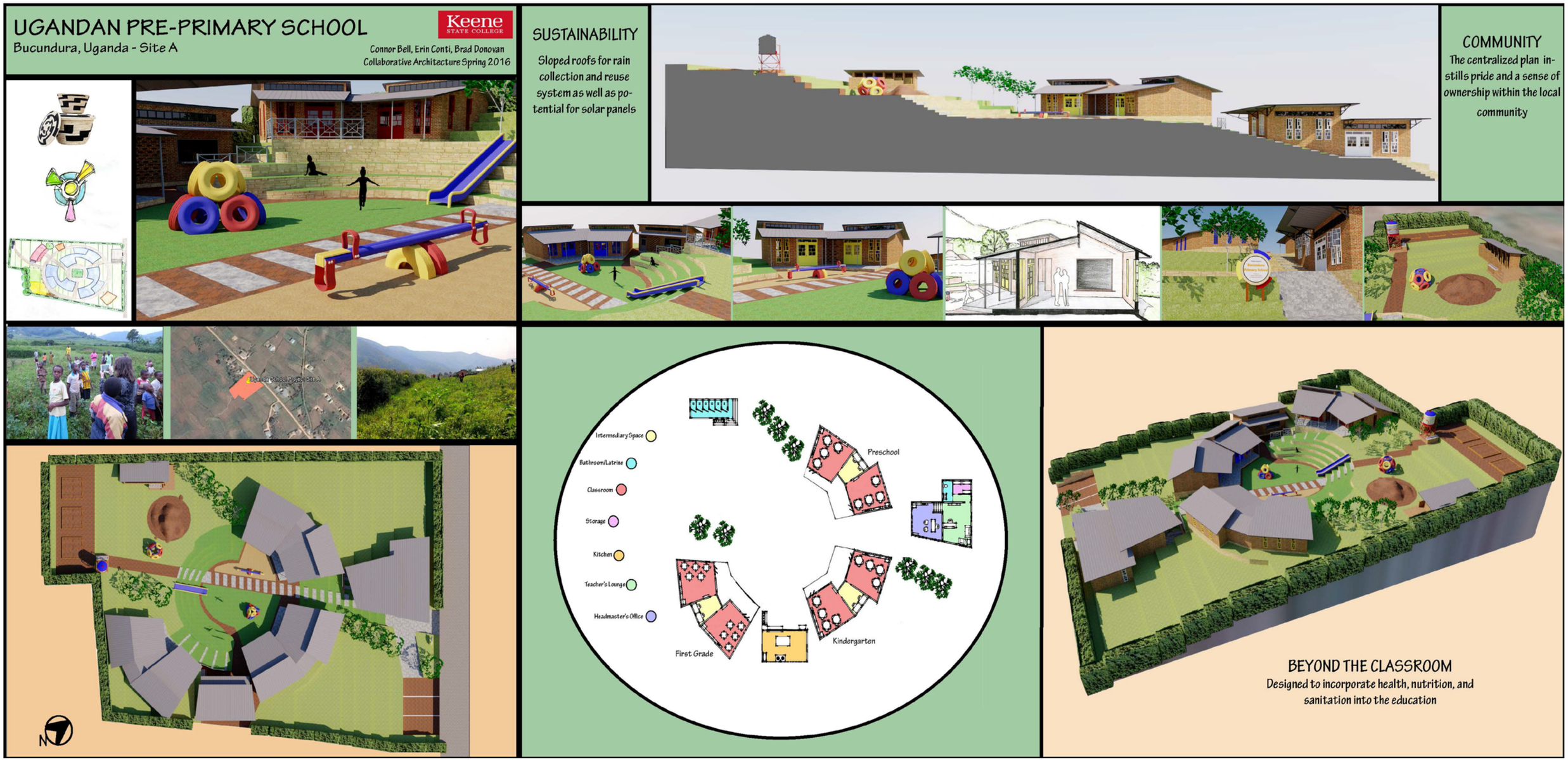
Final Presentation Board



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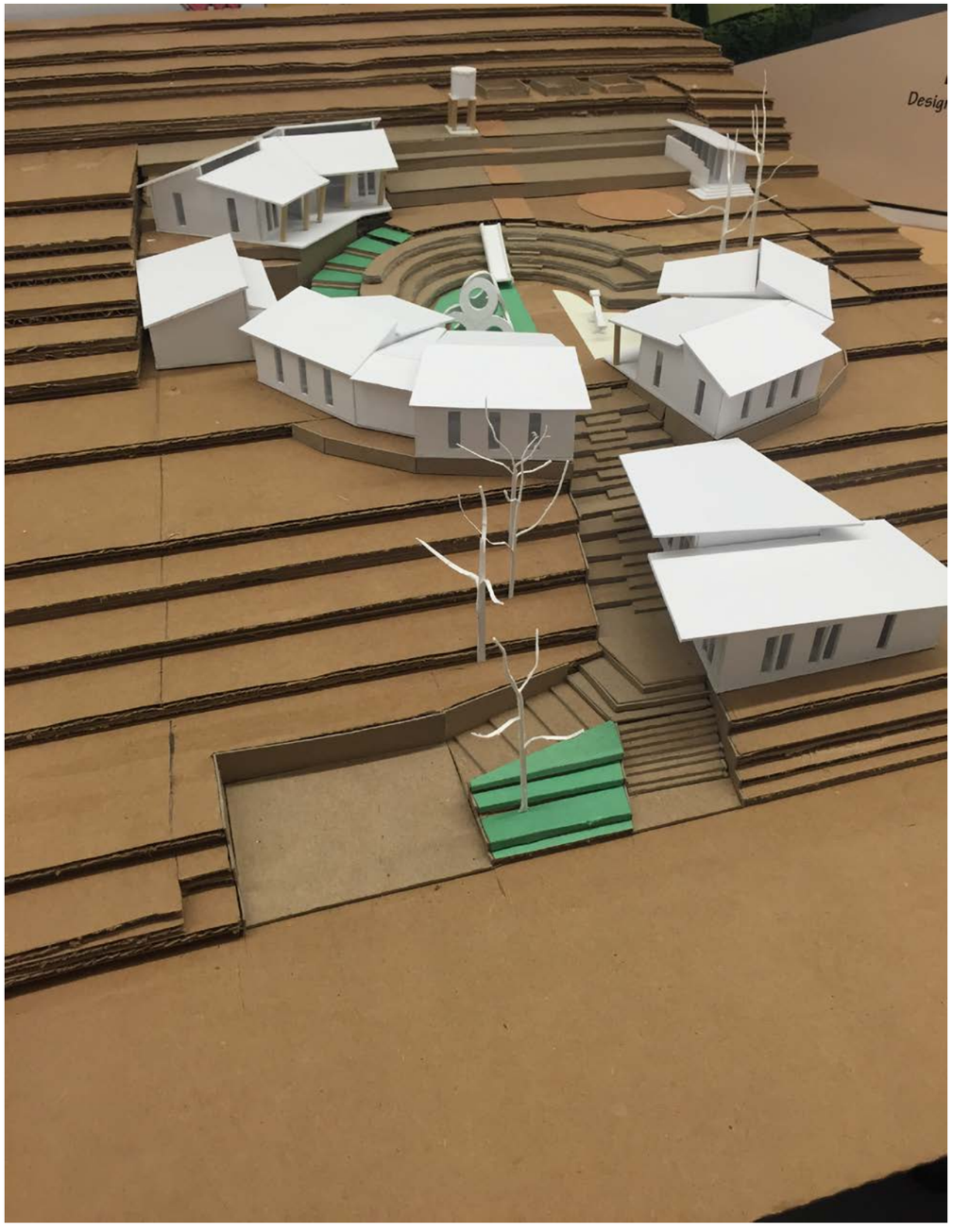
Photos of 1/4”= 1”-0” Scale Model



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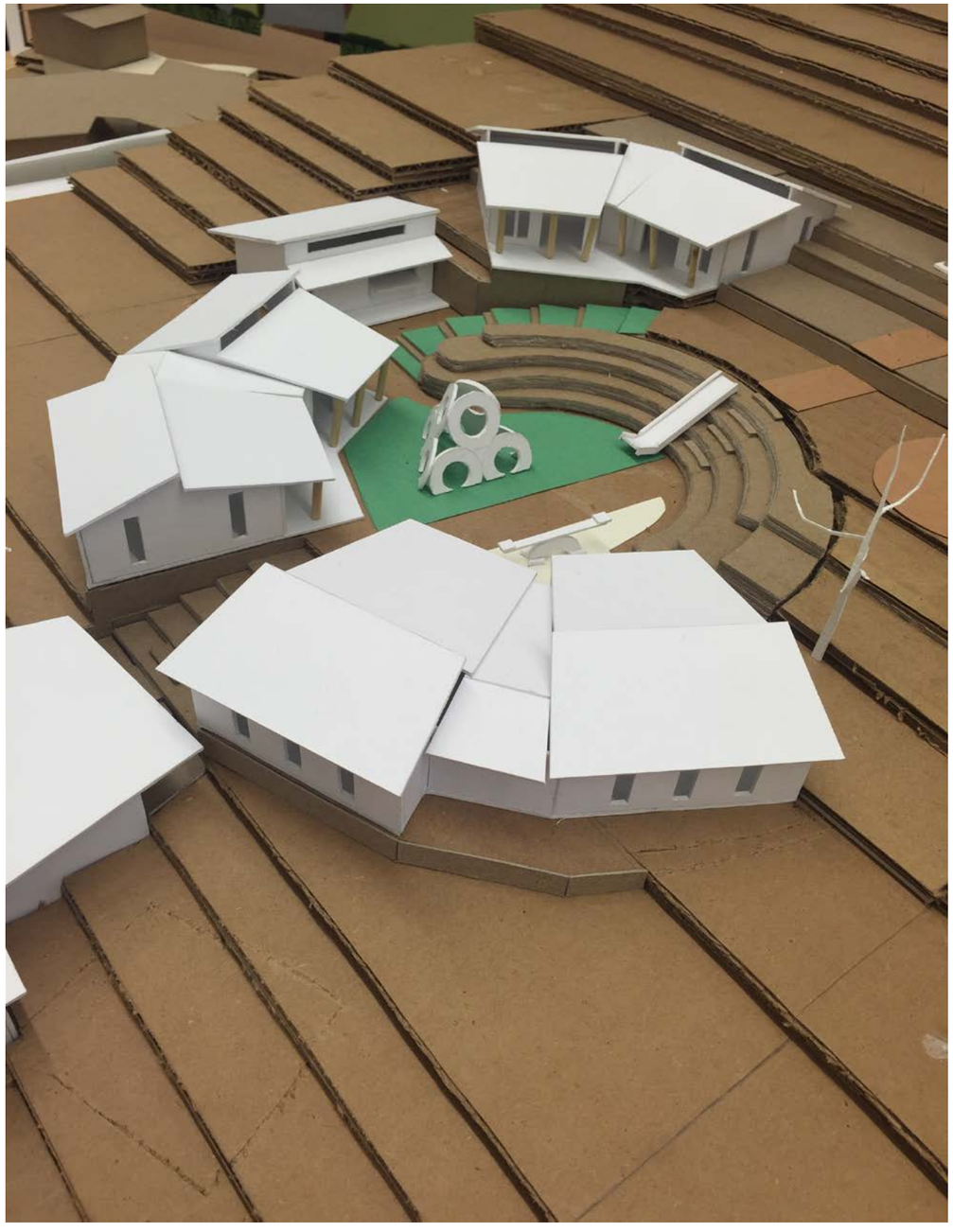
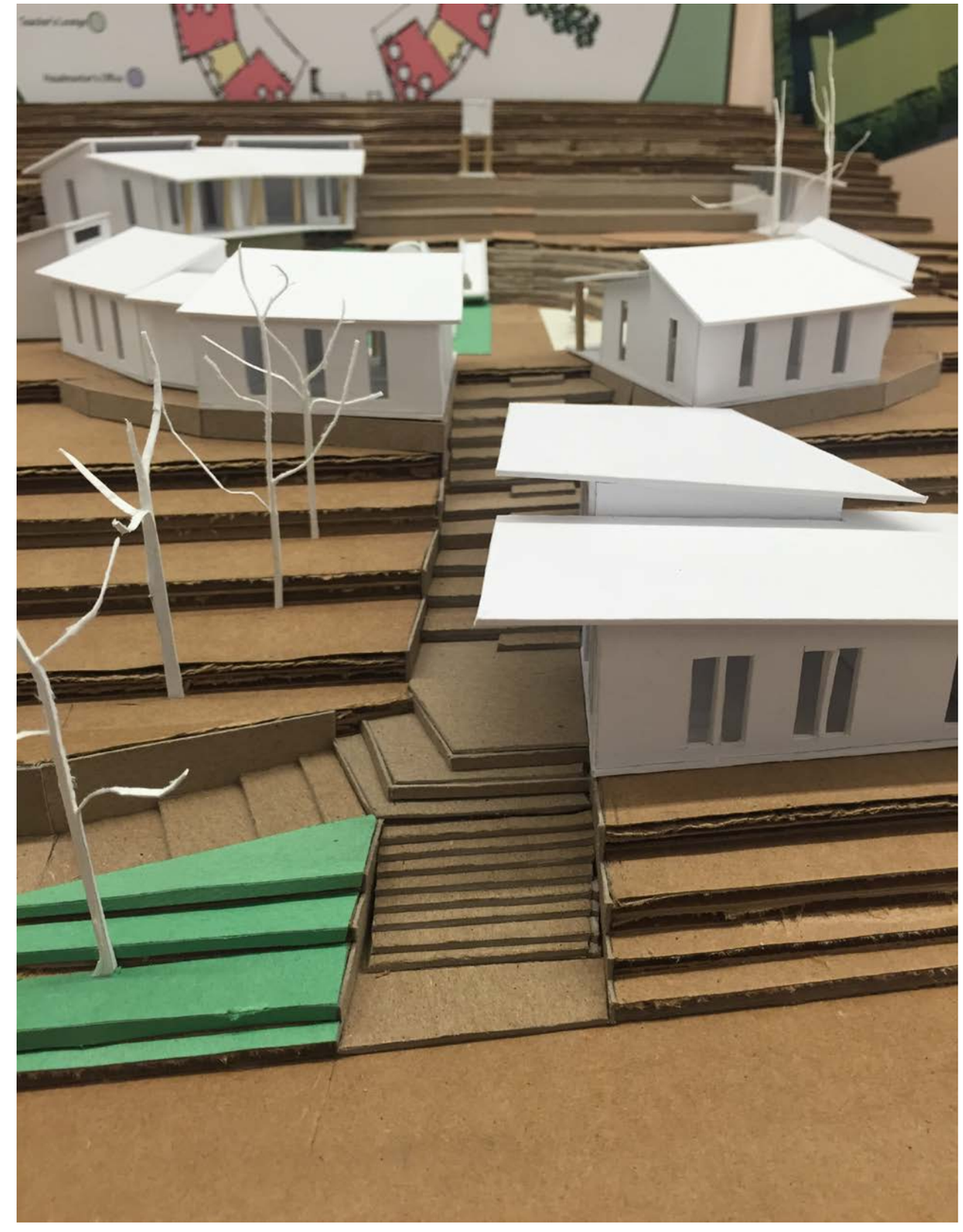
Photos of 1/4”= 1”-0” Scale Model





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